BALLUFF

BIS V-6107-039-C_ _ _

Technical Description, User's Guide

english

www.balluff.com

1 User instructions

1.1 About this Manual

This manual describes the processor unit for BIS V-6107 Identification Systems and startup instructions for immediate operation.

1.2 Typographical Conventions

The following conventions are used in this manual.

Actions

Action instructions are indicated by a preceding triangle. The result of an action is indicated by an arrow.

► Action instruction 1.
⇒ Action result.

► Action instruction 2.

Syntax

Numbers:
– Decimal numbers are shown without additional indicators (e.g. 123),
– Hexadecimal numbers are shown with the additional indicator $_{hex}$ (e.g. 00_{hex}).

Parameters:
Parameters are shown in italics (e.g. CRC_*16*).

Directory paths:
References to paths in which data are stored or are to be saved to are shown in small caps (e.g. PROJECT:\DATA TYPES\USER DEFINED).

Control characters:
Control characters for sending are set in angle brackets (e.g. <ACK>).

ASCII code:
Characters transmitted in ASCII code are set in apostrophes (e.g. 'L').

1.3 Symbols

Note, tip
This symbol indicates general notes.

1.4 Meaning of Warning Notes

Warning notes are especially safety-relevant and are used for accident avoidance. This information must be read thoroughly and followed exactly. The warning notes are constructed as follows:

SIGNAL WORD
Type and source of the hazard
Consequences of non-observance
► Measures for hazard avoidance

The signal words used have the following meaning:

NOTICE
The warning word NOTICE indicates a risk which can result in **damage to or destruction of the product**.

CAUTION
The general warning symbol combined with the signal word CAUTION indicates a risk which can result in **slight or moderate injuries**.

WARNING
The general warning symbol combined with the signal word WARNING indicates a risk which can result in **serious injury or death**.

DANGER
The general warning symbol combined with the signal word DANGER indicates a risk which can result **directly in serious injury or death**.

1 User instructions

1.5 Abbreviations

BCC	Block Check Character
BIS	Balluff Identification System
CP	Code Present
CRC	Cyclic Redundancy Check
I/O port	Digital input and output port
EEPROM	Electrical Erasable and Programmable ROM
EIRP	Equivalent Isotropically Radiated Power
EMC	Electromagnetic Compatibility
ERP	Effective Radiated Power
EPC	Electronic Product Code
FE	Function ground
IP	Internet Protocol
kB	Kilobyte
LAN	Local Area Network
MAC-ID	Media Access Control Identifier
MB	Megabyte
n.c.	not connected
PC	Personal Computer
RSSI	Receive Signal Strength Indicator
PLC	Programmable Logic Controller
Tag	Data carrier
TCP	Transmission Control Protocol
TID	Tag-Identifier
UHF	Ultra high frequency
UID	Unique Identifier
USB	Universal Serial BUS

2 Safety

2.1 Intended use

This reference manual applies to processor units in the following series:
- BIS V-6107-039-C005
- BIS V-6107-039-C105
- BIS V-6107-039-C006
- BIS V-6107-039-C106
- BIS V-6107-039-C007
- BIS V-6107-039-C107
- BIS V-6107-039-C008
- BIS V-6107-039-C108

The BIS V-6107 is part of the BIS V identification system and is used for linking the system to a host controller PC,…). The processor unit may be used only for this purpose and with adherence to any national prevailing regulations.

2.2 General Safety Notes

Installation and startup
Installation and startup are to be performed by trained technical personnel only.

Warranty and liability claims against the manufacturer are rendered void by:
- Unauthorized tampering
- Improper use
- Use, installation or handling contrary to the instructions provided in this User's Guide.

2.3 Conformity

CE Conformity

CE	This product was developed and manufactured in accordance with all applicable European Directives. CE conformity has been verified.

UL Conformity

c UL us LISTED	This product is UL certified. Process Control Equipment Control No. 3TLJ File No. E227256

> **Note**
> This is a Class A product. This product may generate RF interference in residential areas. In such cases it is the responsibility of the user to take appropriate measures.

All approvals and certifications are no longer valid if
- Components are used that are not part of the BIS V Identification System.
- Components are used that have not been explicitly approved by Balluff.

Operation and testing
- The operator is responsible for ensuring that local safety regulations are observed
- Intended use is ensured only when the housing is fully installed
- The IP65 enclosure rating is only assured if cables are connected to all terminals or cover caps are employed

► In case of defects and non-correctable faults, immediately take the vision system out of service and secure it against unauthorized use.

2 Safety

2.4 General Safety Notes

- ► Before connecting the processor unit to a power supply or to an external controller please read this User's Guide carefully.
- ► Observe all safety instructions without exception.

⚠ **NOTICE**

Exceeding maximum current draw

When the maximum current draw is exceeded damage to the processor unit and any connected system components may result.

- ► Ensure that the total current carried through the Power terminal does not exceed 8 A during operation.
- ► Operate the processor unit on a limited voltage source with a maximum output current of 8 A (LPS Class 2).

⚠ **NOTICE**

Exceeding the total current per pin

Exceeding the maximum current draw per pin may damage the processor unit and any connected system components.

- ► Be sure that the total current per pin on terminals H1 to H4 and IO-Link does not exceed 4 A.

2.5 Disposal

- ► Observe the national regulations for disposal.

3 Basic knowledge

3.1 Function principle of identification systems

The identification system BIS V is classified as a non-contacting system with read and write function. Data can be written without contact from a higher level controller to a data carrier (tag) and read back from the tag to the controller.

Main components of the BIS V:
- Processor unit
- Read/write head
- Data carrier

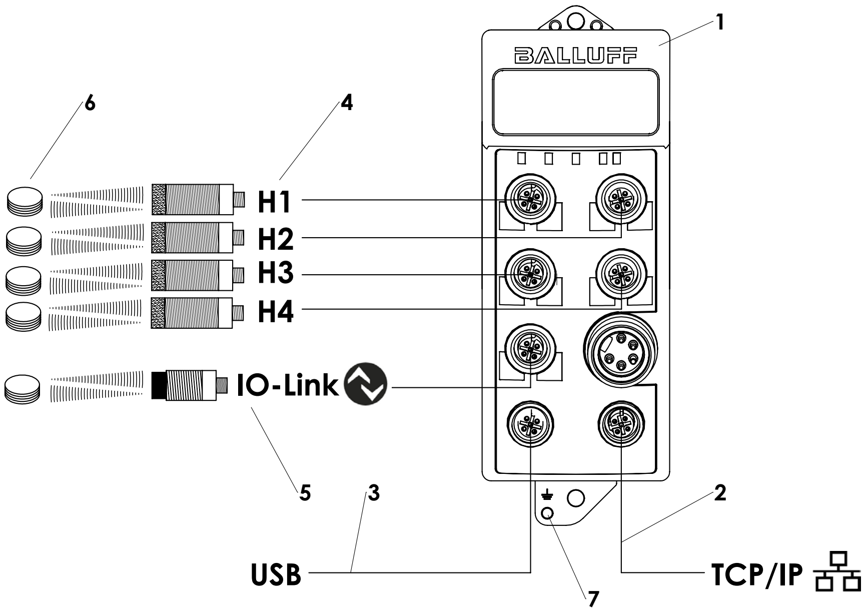


Figure 1: System overview

1	BIS -6107 processor unit	**5**	IO-Link
2	Ethernet TCP/IP port	**6**	RFID data carriers
3	USB port	**7**	Function ground
4	Read/write heads H1...H4		

Main areas of application:
- In the production and control of material flow (e.g. in model-specific processes, workpiece transport in conveying systems, for acquiring safety-related data)
- In warehousing for monitoring material movements
- In transporting and conveyor technology

3.2 Product description

BIS V-6107 processor unit:
- Rugged metal housing
- Rugged round connector terminations
- Simultaneous operation of 4 read/write heads regardless of their technology (LF, HF and UHF)
- Supports series BIS C, BIS VL, BIS VM and BIS VU read/write heads
- 1 IO-Link port freely configurable as IO-Link module + I/O port or 2 I/O ports
- Power for the system components provided by the processor unit
- Power pins for system components are protected against overcurrent
- USB port for quick startup on a PC
- Ethernet TCP/IP port for integration into a local network
- Operation via a Web server
- Display with keys for settings and diagnostics
- Display of the current operating status

3 Basic knowledge

3.3 Scope of delivery

- 1x processor unit BIS V-6107
- 1x grounding set
- 5x end caps
- User's manual
- Safety Notes

3.4 Software and accessories

For information about available software and accessories visit www.balluff.com.

3.5 Control function of the processor unit

The processor unit is the link between data carrier and controlling system. It manages two-way data transfer between data carrier and R/W head and provides buffer storage.
The processor unit uses the read/write head to write data from the controlling system to the data carrier or reads the data from the carrier and makes it available to the controlling system.

Host systems may be the following:
- a control computer (e.g. industrial PC)
- a PLC

3.6 Data security of the data carrier

In order to increase data integrity, data transfer between the data carrier and processor unit and the storage device must be monitored using a check procedure.
A CRC_16 data check can be enabled for this via parameter configuration.
With the CRC_16 data check, a check code that allows the validity to be checked at any time is written to the data carrier.

A CRC_16 data check provides the following advantages:
- Data integrity even during the non-active phase (data carrier outside the R/W head)
- Shorter read time – page is read once

3.7 Data security of the application interfaces

The BIS V-6107 processor unit provides the application interfaces Ethernet TCP/IP and USB. By design these transmission media already have their own security procedures which run in the background of the controller or PC. In addition the user data of the serial Balluff protocol are verified using a simple *Block Check Character* , see Section 9 Protocol on page 48.

3 Basic knowledge

3.8 Read/write heads H1...H4

Read/write heads from different series and of different technologies can be connected to terminals H1...H4. An overview can be found in the table below.

Processor unit	Available Connections	Compatible Read/Write Heads			
	H1…H4	VM-3_ _	VL-3_ _	VU-3_ _	C-3_ _
BIS V-6107-039-C005	H1…H4	YES	YES	YES	NO
BIS V-6107-039-C105	H1…H4	YES	YES	YES	YES
BIS V-6107-039-C006	H1…H4	YES	YES	YES	NO
BIS V-6107-039-C106	H1…H4	YES	YES	YES	YES
BIS V-6107-039-C007	H1…H4	YES	YES	YES	NO
BIS V-6107-039-C107	H1…H4	YES	YES	YES	YES
BIS V-6107-039-C008	H1…H4	YES	YES	YES	NO
BIS V-6107-039-C108	H1…H4	YES	YES	YES	YES

Note
Device software as well as manuals with detailed information about the read/write heads used are available at www.balluff.com.

BIS V-6107 processor units are available in different variants with respect to the supported read/write heads. The following table shows the differences.

Series	Frequency range	Operating principle
BIS C_ _	LF	Inductive
BIS VL_ _	LF	Inductive
BIS VM_ _	HF	Inductive
BIS VU_ _	UHF	Electromagnetic

Notes

► Use only shielded cables to connect read/write heads.

- An adapter cable is required for connecting read/write heads in the BIS C-3_ _ series.
- The maximum cable length for read/write heads of the BIS VL/VM/VU-3_ _series is 50 m.
- For series BIS C3-_ _ read/write heads the cable length is determined by the model and cannot be extended. Versions with cable lengths of 1 m, 5 m and 10 m are available.

3 Basic knowledge

3.9 USB

The USB 1.1 Full-Speed-Port can be used to connect the BIS V-6107 processor unit to any USB 1.1 compatible USB port. The BIS V-6107 is detected by the PC as a system component as soon as it is plugged in and displayed as an interchangeable data carrier with a memory capacity of > 15 MB.
Use of the USB port as an application interface on a Windows PC (32-bit/64-bit) requires installation of a driver. After installation the processor unit functions are available on a virtual COM port.

System requirements:
- USB 1.1 compatible USB port
- Operating system: Windows XP or higher
- Hard disk space: 72 kB

Note
To use the USB port the processor unit must be powered at the *Power* terminal (see Section 5 Technical data).

► Use only shielded USB cable with a maximum length of 5 m.

For data transmission over longer distances use of active hubs or repeaters is recommended.
Drivers for operating the USB port as an application interface are stored on the interchangeable data carrier of the BIS V group.

3.10 Ethernet TCP/IP

The Ethernet TCP/IP port can be used for integrating the processor unit into a local network. The 10BASE-T/100BASE-TX Ethernet connection can be used to send data with a transmission rate of 10/100 MBit/s.

Note

► Use only shielded Ethernet cable with a maximum length of 100 m.

For data transmission over longer distances the use of repeaters is recommended.

3 Basic knowledge

3.11 IO-Link port

IO-Link is defined as a standardized point-to-point connection between sensors/actuators and an I/O module. An IO-Link sensor/actuator can send additional communication data (e.g. diagnostics signals) in addition to the binary process signals over the IO-Link interface.

Compatibility with standard I/O:

- IO-Link sensors/actuators can be connected to existing I/O modules if they are operated in SIO mode
- Sensors/actuators that are not IO-Link-capable can be connected to a decentral IO-Link module
- Standard sensor/actuator cables can be used

Key technical data:

- Serial point-to-point connection
- Communication as add-on to standard I/O
- Standard I/O connection technology, unshielded, 20 m cable length
- Communication using 24 V pulse modulation, standard UART protocol

The IO-Link port can be operated in various modes. Functions are available on pins 2 and 4.

Pin 2 of the IO-Link port can be configured for the following standard I/O operating modes:

- Input as normally open contact
- Input as normally closed contact
- Output

Pin 4 of the IO-Link port can be configured for the following standard I/O operating modes:

- Input as normally open contact
- Input as normally closed contact
- Output
- IO-Link communication
- IO-Link input as normally open contact with SIO function
- IO-Link input as normally closed contact with SIO function

In SIO mode an IO-Link device can be configured via IO-Link and afterward switched over to an SIO mode in which the IO-Link port pin functions as a simple switch input.

Connected IO-Link and I/O modules are powered by the processor unit. For information about supply voltage and maximum current capacity, see Section 5 Technical data.

4 Installation

4.1 Processor Unit Installation

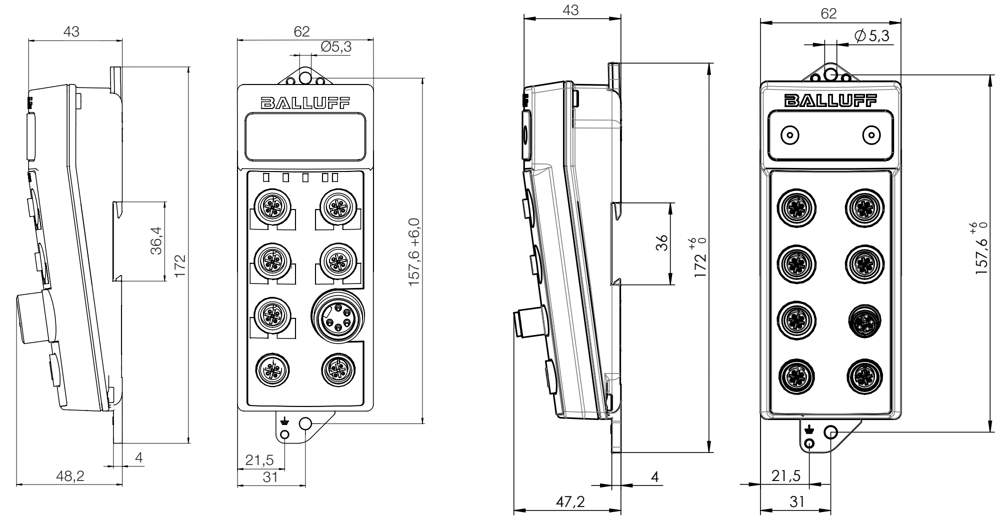


Figure 2: Mechanical connection (dimensions in mm)

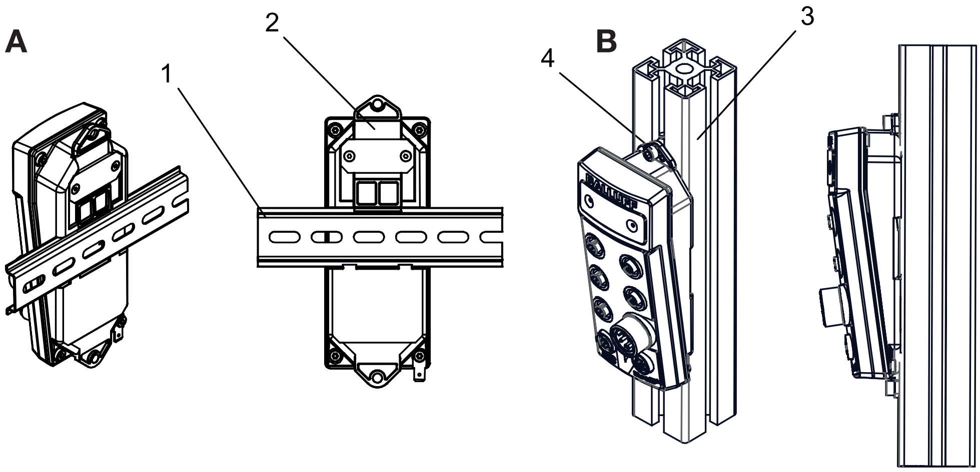


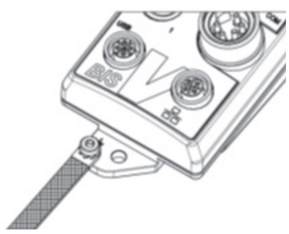
Figure 3: Installation examples (A: attachment to DIN rails, B: attachment to T-slotted framing)

1	Top-hat rail	**3**	T-slotted framing
2	Fastening	**4**	Holder for screw mounting

- ► Select a suitable installation position.
- ► Secure the processor unit using two M5 screws (strength category 8.8, lightly oiled, tightening torque M = 5.5 Nm).

4.2 Grounding

Note
When installing the BIS V assembly in strong EMC environments we recommend connecting the housing from the FE terminal directly to ground. The ground connection should be short and stable. A grounding set is included with the product. When using other double-ended cordsets we recommend using a similar conductor gauge.



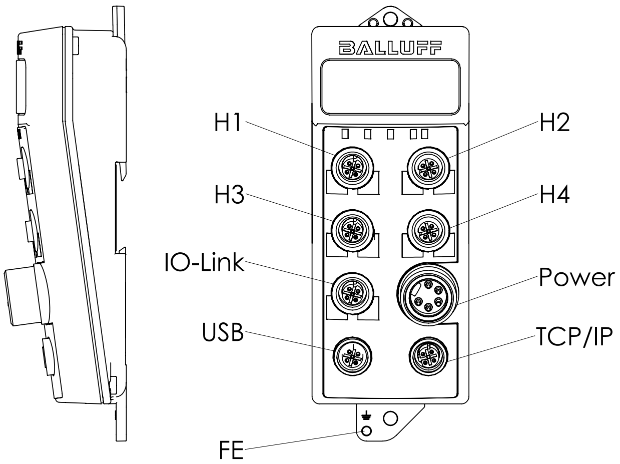
Depending on the installation situation low-frequency noise from ground loops may arise. To interrupt the ground loop the FE terminal can be connected indi-rectly using an RC combination.

4 Installation

4.3 Electrical connection

> **Note**
> ► Fit unused plug terminals with caps to ensure the IP65 enclosure rating.

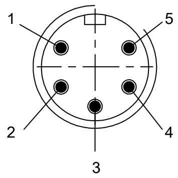
Connections



Power	Supply voltage BIS V and IO-Link and I/O modules
H1…H4	Read/Write Heads
USB	USB-Port
TCP/IP	Ethernet TCP/IP-Port
FE	Function ground

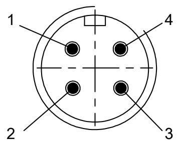
Figure 4: Electrical connection

Power
5-pin 7/8" plug
BIS V-6107-039-C005, BIS V-6107-039-C105



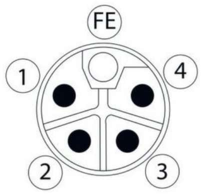
PIN	Function	Description
1	0 V	Reference potential
2	0 V	Reference potential
3	FE	Function ground
4	+24 V DC	Supply voltage (V_S) 8 A max.
5	–	Reserved, not connected

Power
4-pin 7/8" male
BIS V-6107-039-C006, BIS V-6107-039-C106



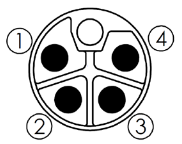
PIN	Function	Description
1	0 V	Reference potential
2	0 V	Reference potential
3	–	Reserved, not connected
4	+24 V DC	Supply voltage (V_S) 8 A max.

4 Installation



Power
M12 male, 5-pin, L-coded
BIS V-6107-039-C007, BIS V-6107-039-C107

PIN	Function	Description
1	+24 V DC	Supply voltage US
2	0 V, UA	Reference potential UA
3	0 V, US	Reference potential US
4	+24 V DC	Supply voltage, auxiliary voltage UA
5	FE	Function ground



Power
M12 male, 4-pin, L-coded
BIS V-6107-039-C008, BIS V-6107-039-C108

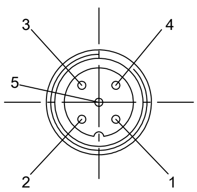
PIN	Function	Description
1	+24 V DC	Supply voltage US
2	0 V, UA	Reference potential UA
3	0 V, US	Reference potential US
4	+24 V DC	Supply voltage, auxiliary voltage UA

⚠ NOTICE

Exceeding maximum current draw

When the maximum current draw is exceeded damage to the processor unit and any connected system components may result.

- ► Ensure that the total current carried through the *Power* terminal does not exceed 8 A during operation.
- ► Operate the processor unit on a limited voltage source with a maximum output current of 8 A (LPS Class 2).

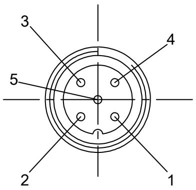


H1…H4
M12 female, 5-pin, A-coded

PIN	Function	Description
1	V_S	Supply voltage for read/write heads Output V_S/800 mA max.
2	COM_A	Data line A
3	0 V	Reference potential
4	COM_B	Data line B
5	–	Not used

4 Installation

IO-Link
M12 female, 5-pin, A-coded



PIN	Function	Description
1	V_S	Supply voltage for IO-Link devices Output V_S /1.7 A max.
2	I/O	Input / output max. 2A
3	0 V	Reference potential
4	Q/C, E/A	Q/C (IO-Link), input/output 2 A max
5	–	Not used

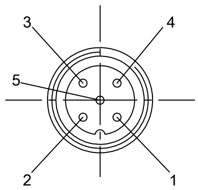
NOTICE

Exceeding the total current per pin

Exceeding the maximum current draw per pin may damage the processor unit and any connected system components.

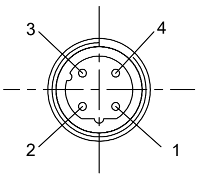
► Be sure that the total current per pin on terminals H1 to H4 and IO-Link does not exceed 4 A.

USB
M12 female, 5-pin, A-coded



PIN	Function	Description
1	–	Not used
2	USB–	Data line USB–
3	0 V	Reference potential
4	–	Not used
5	USB+	Data line USB+

EtherNET TCP/IP
M12 female, 4-pin, D-coded



PIN	Function	Description
1	+TX	Data line Sender +
2	+RX	Data line Receiver +
3	–TX	Data line Sender –
4	–TX	Data line Receiver –

5 Technical data

5.1 Dimensions

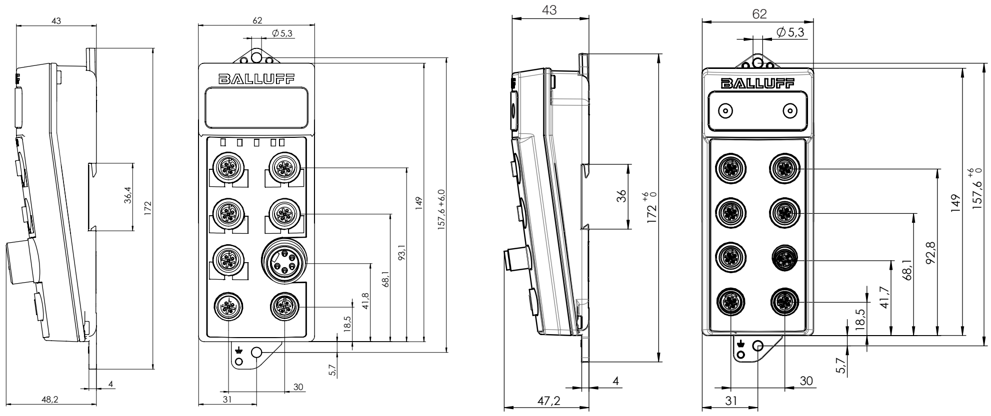


Figure 5: Dimensions in mm

5.2 Mechanical data

Housing material	GD-Zn (zinc, die-cast)
Power BIS V-6107-039-**C_05** BIS V-6107-039-**C_06** BIS V-6107-039-**C_07** BIS V-6107-039-**C_08**	 7/8" male, 5-pin, A-coded 7/8" male, 4-pin, A-coded M12 male, 5-pin, L-coded M12 male, 4-pin, L-coded
H1…H4	M12 female, 5-pin, A-coded
IO-Link	M12 female, 5-pin, A-coded
USB	M12 female, 5-pin, A-coded
TCP/IP	M12 female, 4-pin, D-coded
Degree of protection	IP65 (only when plugged-in and screwed-in)
Weight	800 g

5 Technical Data

5.3 Electrical data

Voltage source	LPS Class 2
Operating voltage V_S	⎓ 24 VDC ±20%
Residual ripple	< 1%
Current draw at V_S 24 V without external devices	150 mA
Maximum current draw	8 A (LPS Class 2)
Verlustleistung ohne S/L-Köpfe	3,2 Watt
Verlustleistung mit S/L-Köpfe und IO-Link Kopf	3,6 Watt
Application interfaces	Ethernet TCP/IP USB
Connections for external devices	4x read/write heads 1x IO-Link

⚠ **NOTICE**

Exceeding maximum current draw

When the maximum current draw is exceeded damage to the processor unit and any connected system components may result.

- ► Ensure that the total current carried through the *Power* terminal does not exceed 8 A during operation.
- ► Operate the processor unit on a limited voltage source with a maximum output current of 8 A (LPS Class 2).

5.4 Connections H1…H4 (read/write heads)

Supply voltage for read/write heads (output)	$V_S – V_D$ (V_D = 0.5 V…3 V, load-dependent) 800 mA max. (protected by overvoltage shut-off)
Serial interface	RS485
Data rate	230.4 kBit/s
Cable type	Shielded, 4-conductor
Cable length max.	50 m

5 Technical Data

5.5 Connection IO-Link

IO-Link revision	1.1
Supply voltage for IO-Link, I/O modules (output)	$V_S - V_D$ (V_D = 0.5 V…3 V, load-dependent) 1.7 A max. (protected by overvoltage shut-off)
Data rate (IO-Link) COM1 COM2 COM3	 4.8 kBit/s 38.4 kBit/s 230.4 kBit/s
Pin 2/Pin 4 (I/O mode) input/output	$V_S - V_D$ (V_D = 0.5 V…3 V, load-dependent) 2 A max.
Pin 4 (IO-Link mode)	C/Q IO-Link data transmission
Cable type	Unshielded, 4-conductor[1)]
Cable length max.	20 m (in IO-Link mode)

NOTICE

Exceeding the total current per pin

Exceeding the maximum current draw per pin may damage the processor unit and any connected system components.

► Be sure that the total current per pin on terminals H1 to H4 and IO-Link does not exceed 4 A.

1) When using IO-Link RFID read/write heads in electromagnetic noise environments the use of shielded cables is recommended.

5.6 Connection Ethernet TCP/IP

Ethernet Standards	10BASE-T/100BASE-TX
Protocol	TCP/IP
Data rates max.	10/100 MBit/s
Cable types	CAT-3 (only 10BASE-T) CAT-5
Cable length max.	100 m

Note
For data transmission over longer distances Balluff recommends the use of repeaters.

5.7 Connection USB

USB version	USB 1.1
Data rate max.	12 MBit/s
Cable type	Shielded, 3-conductor (USB+, USB–, 0 V)
Cable length max.	5 m

Note
For data transmission over longer distances the use of repeaters is recommended.

5.8 Environmental conditions

Ambient temperature	0 °C…+60 °C
Storage temperature	0 °C…+60 °C
Vibration/shock	EN 60068 Part 2-6/27

5 Technical Data

5.9 EMC (Electromagnetic Compatibility)

BIS V-6107-039-C005/BIS V-6107-039-C006		
Harmonized standards EN 61131-2 (Immunity) EN 61131-2 (Emission)	EN 61000-4-2 – Direct contact discharge – Direct air discharge – Indirect contact discharge	 – Severity level 2A – Severity level 3A – Severity level 2A
	EN 61000-4-3 – 80 MHz…1000 MHz – 1400 MHz…2000 MHz – 2000 MHz…2700 MHz	 – Severity level 3A – Severity level 3A – Severity level 2A
	EN 61000-4-4 – Signal lines – Supply lines	 – Severity level 3A – Severity level 3B
	EN 61000-4-5 (supply lines) – Cable to cable (2 Ω) – Cable to ground (12 Ω)	 – Severity level 1B – Severity level 1A
	EN 61000-4-5 (signal lines) – Shield to ground (2 Ω)	 – Severity level 2A
	EN 61000-4-6	– Severity level 3A
	EN 55016-2-3	– EN 61000-6-4

BIS V-6107-039-C105/BIS V-6107-039-C106		
Harmonized standards EN 301489-1/3 (Immunity) EN 301489-1/3 (Emission) EN 300330-2 EN 50364	EN 61000-4-2 – Direct contact discharge – Indirect contact discharge	 – Severity level 2A – Severity level 2A
	EN 61000-4-3 – 80 MHz…1000 MHz – 1400 MHz…2000 MHz – 2000 MHz…2700 MHz	 – Severity level 2A – Severity level 2A – Severity level 2A
	EN 61000-4-4 – Signal lines – Supply lines	 – Severity level 2A – Severity level 3B
	EN 61000-4-5 – Signal port to GND (2 Ω)	 – Severity level 2A
	EN 61000-4-6	– Severity level 2A
	EN 301489-1/3 (Emission)	– EN 55022, Class A

Note
Detailed and binding data for approvals, relevant standards and directives can be found in the respective Declarations of Conformity. These are available online at www.balluff.com.

6 Function indicators

The operating states of the identification system, the TCP/IP interface and the IO-Link master are displayed using LEDs.

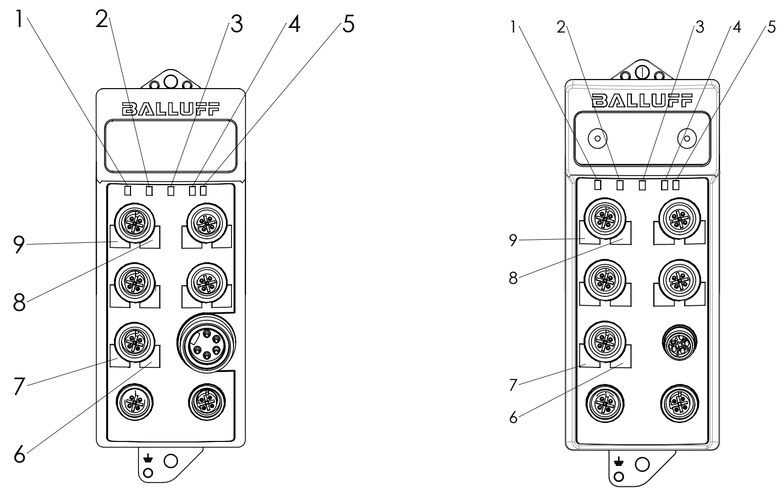


Figure 6: Function indicators

- **1** BIS V Ready (RD)
- **2** USB connection (USB)
- **3** TCP/IP connection ( )
- **4** TCP/IP-Link (L)
- **5** TCP/IP Activity (A)
- **6** IO-Link port pin 2 (1)
- **7** IO-Link port pin 4 (0)
- **8** R/W head communication (COM)
- **9** R/W head Ready (RD)

6.1 BIS V Status

LED	Display	Description
RD	Off	No power or BIS V not ready
	Green	BIS V ready
USB	Off	No USB connection
	Green	USB connection open
	Off	No TCP/IP connection
	Green	TCP/IP connection open
L	Off	Ethernet cable not connected
	Green	Ethernet cable connected
A	Off	No TCP/IP communication
	Green, flashing	TCP/IP communication active

6.2 Read/write head Status

LED	Display	Description
RD	Off	Connection disabled
	Green	R/W head detected
	Green, flashing	No R/W head connected or cable break
COM	Off	No data carrier detected
	Yellow	Data carrier detected (CP)
	Flashing yellow	Data carrier is being processed (read/write)

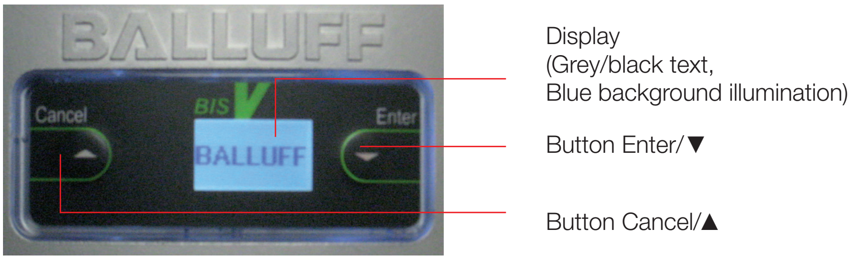
6 Function Indicators

6.3 IO-Link Status

LED	Mode	Display	Description
0/1	I/O	Off	State of the input or output is 0
		Yellow	State of the input or output is 1
		Red	Short circuit on Pin 2/Pin 4
		Red, flashing	Short circuit between Pin 1 and 3 (LED 0 also flashing red)
0	IO-Link	Off	Disabled
		Green	Enabled, no communication
		Green, flashing	Communication active
		Green, flashing (fast)	Run preparation mode
		Red	Short-circuit at pin 4
		Red, flashing (fast)	Data: Memory error or validation error

6.4 Display

The display provides functions for diagnosing the BIS V. This can be used to determine the IP and gateway addresses, the subnet mask, as well as the station name. In addition, tag data, version information and the MAC address can be displayed. It is controlled using a 2-button controller.
You can navigate within a menu level by holding the Enter/▼ or Cancel/▲ keys. You can switch between menu levels or confirm or cancel an action by pressing the buttons longer.

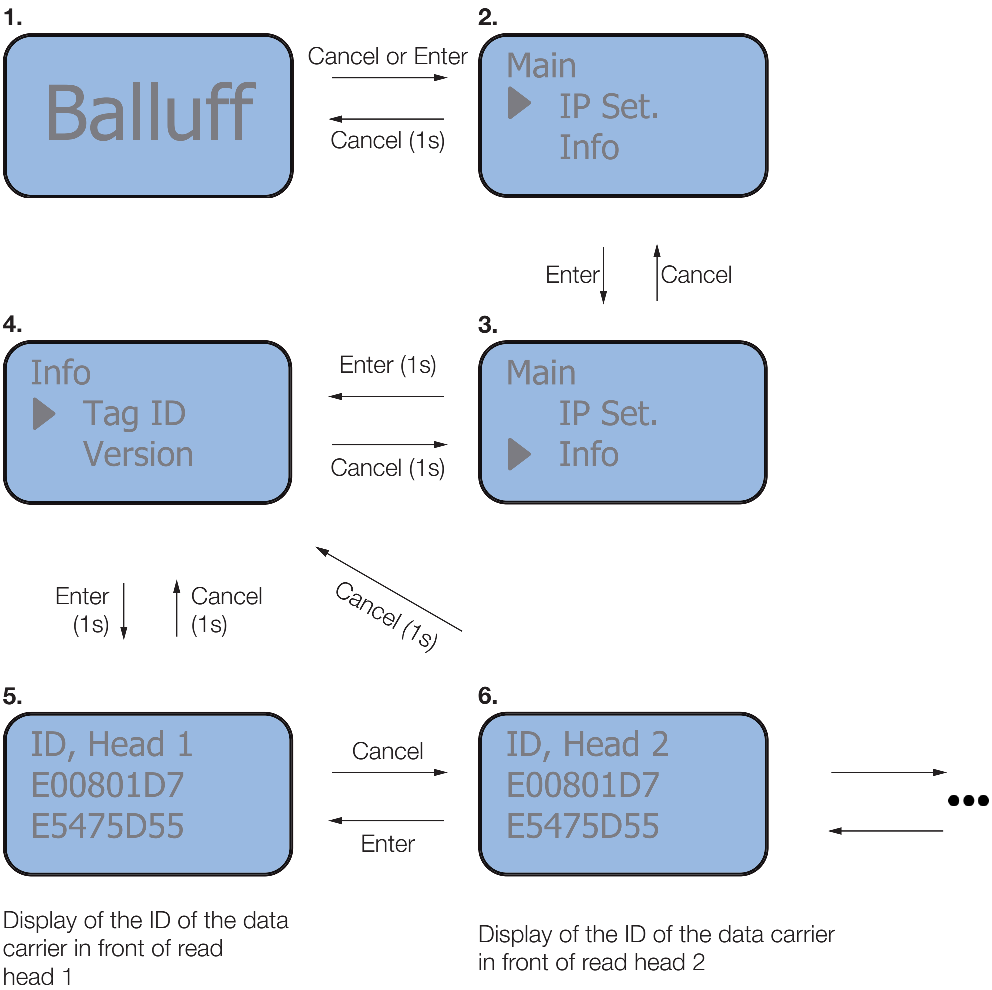


Note
After starting the unit, the last octet of the IP address is shown on the display of the BIS V. This constitutes the default state of the display.

Note
Device settings can only be reset after a power reset without a connected network cable.

6 Function Indicators

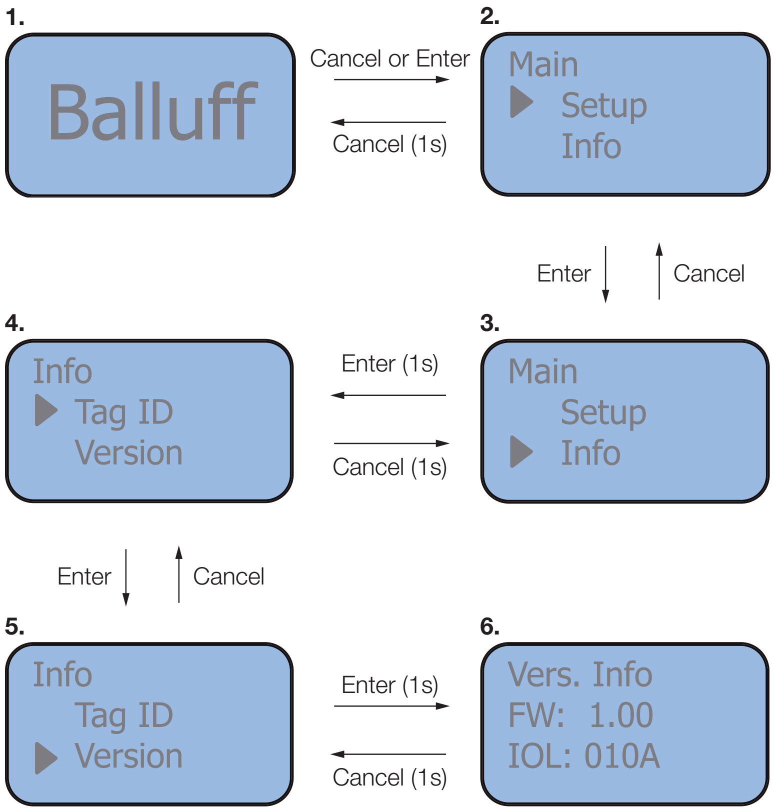
6.5 Displaying tag data



When selecting the Head_IDs 1…4 (5, 6, …) Cancel (1s) can be used to jump back to 4.

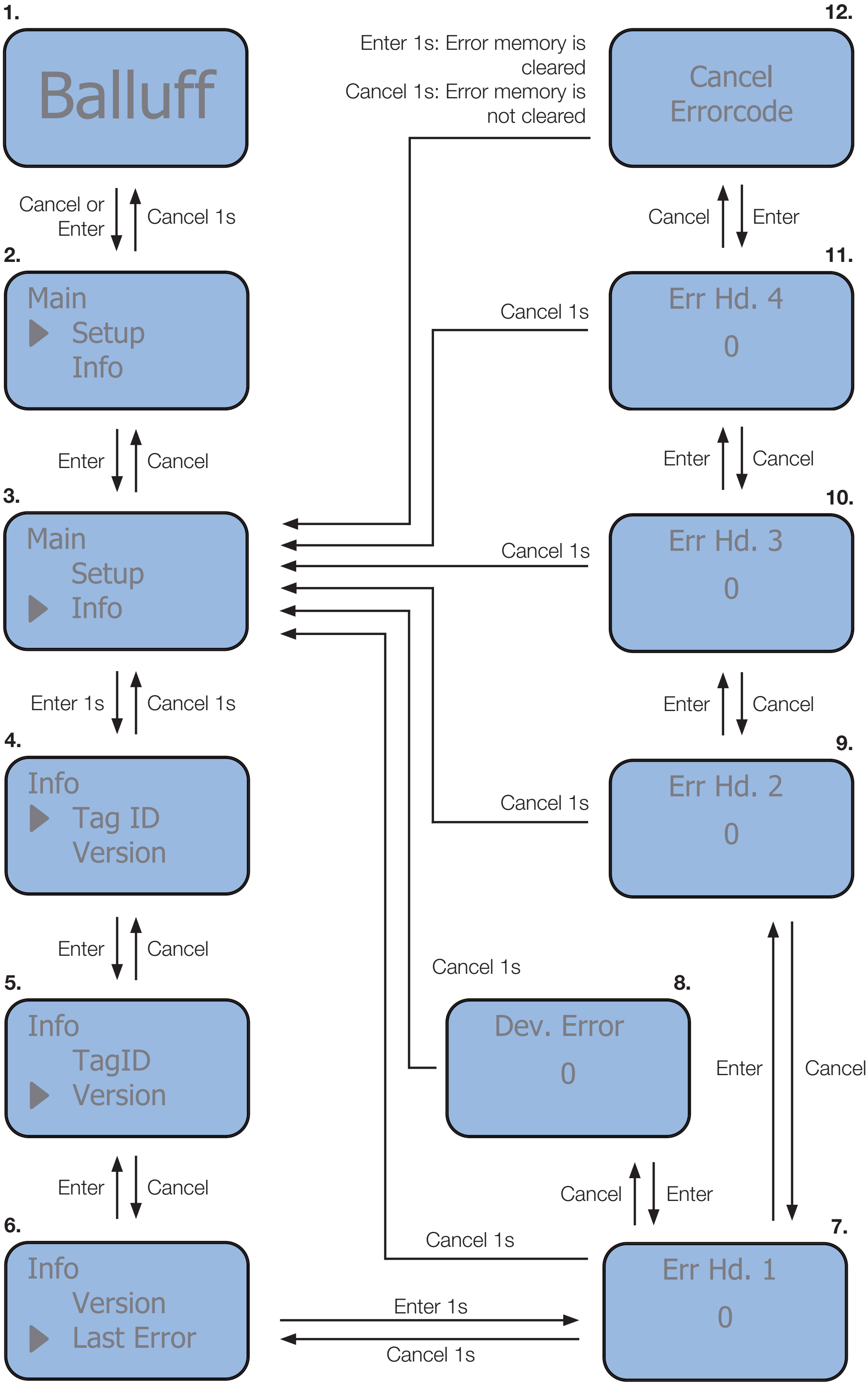
6 Function Indicators

6.6 Version display



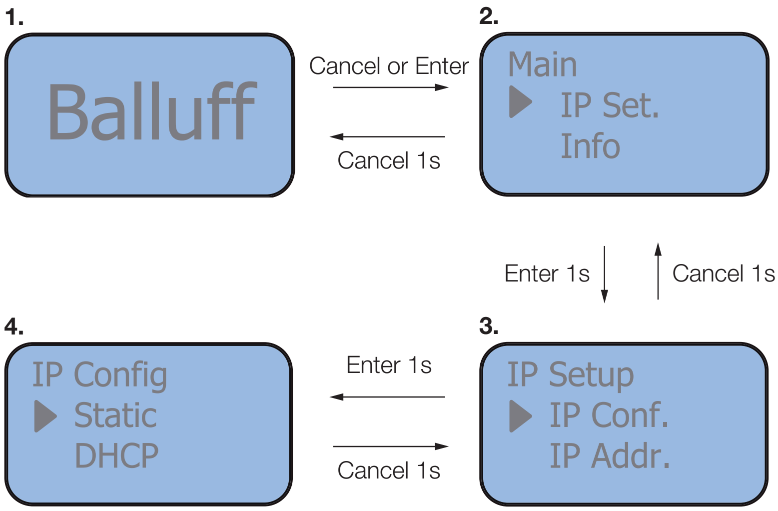
6 Function Indicators

6.7 Error list display

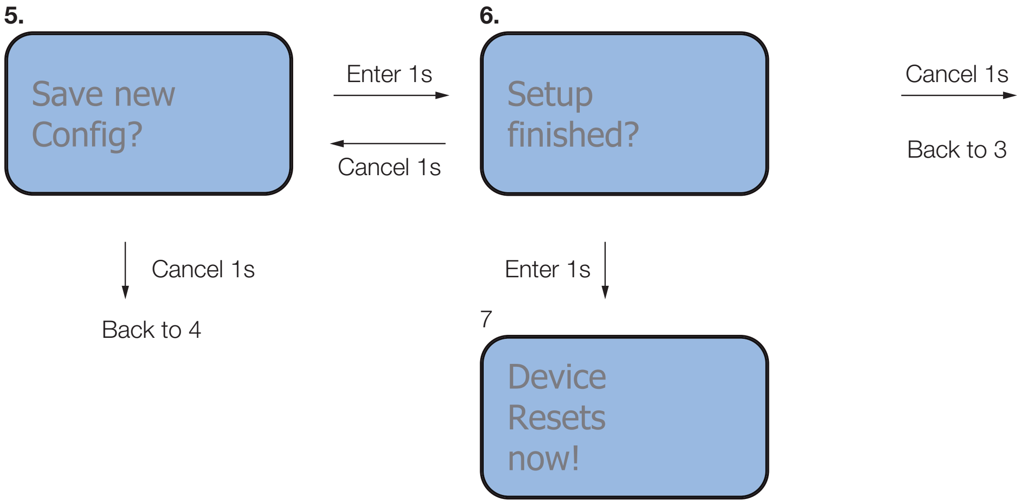


6 Function Indicators

6.8 Configuring the IP configuration

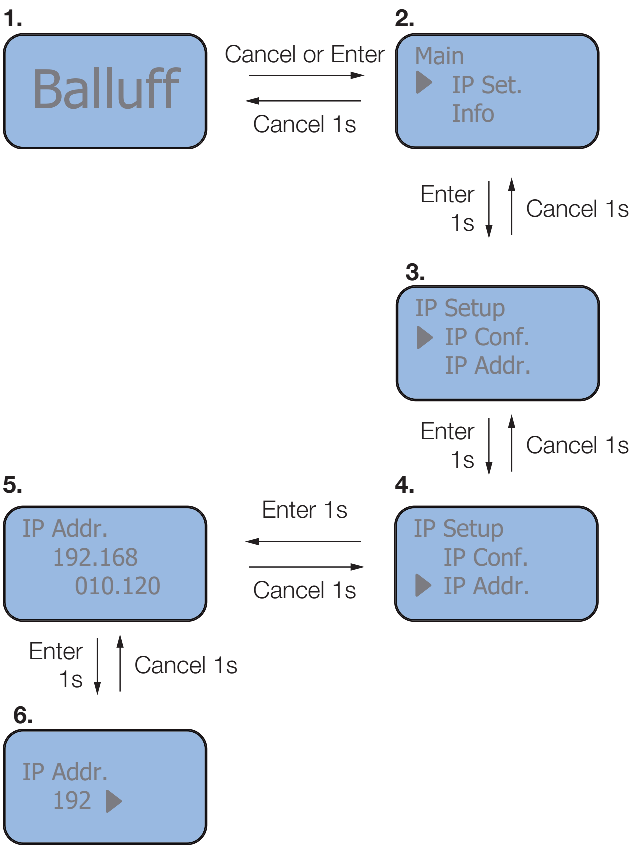


- ▶ Press Enter/Down to select the desired configuration.
- ▶ Pressing Cancel (1 s) cancels the configuration (back to 3).
- ▶ Press Enter (1 s) to apply the selected value.

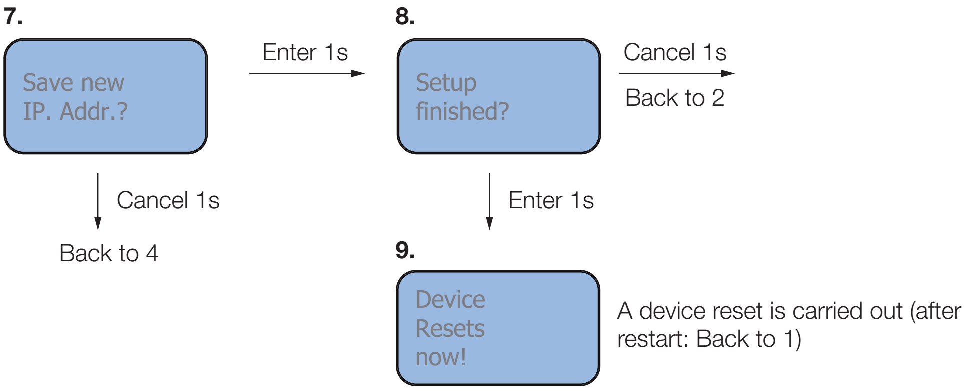


6 Function Indicators

6.9 Configuring the IP address

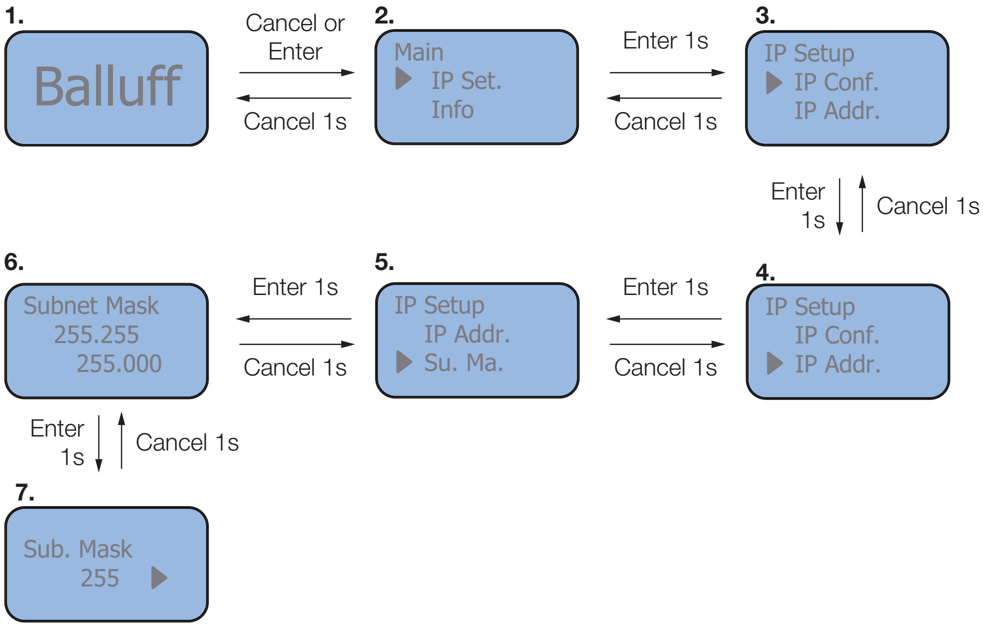


- You can switch through the positions (1st, 2nd, 3rd) by pressing Enter/Down. The current position starts flashing.
- Press Cancel/Up to increase the number at the currently selected position.
- Press Enter (1s) to confirm the configured IP octet and switch to the next IP octet.
- Press Enter (1s) to confirm the configured IP address in the 4th octet.

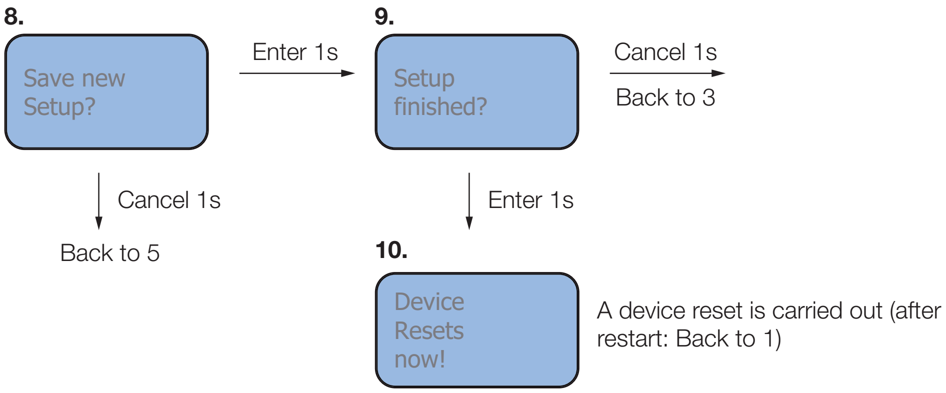


6 Function Indicators

6.10 Configuring the subnet mask

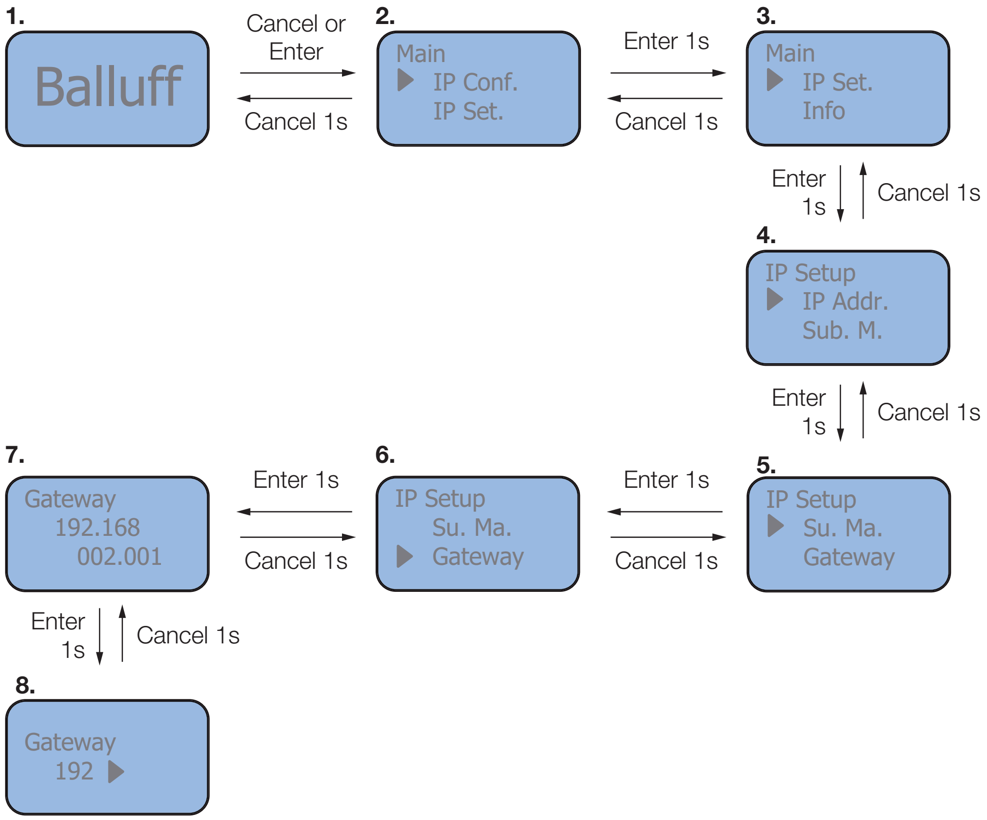


- ▶ You can switch through the positions (1st, 2nd, 3rd) by pressing Enter/Down. The current position starts flashing.
- ▶ Press Cancel/Up to increase the number at the currently selected position.
- ▶ Press Enter (1s) to confirm the configured subnet mask octet and switch to the next octet.
- ▶ Press Enter (1s) to confirm the configured subnet mask in the 4th octet.

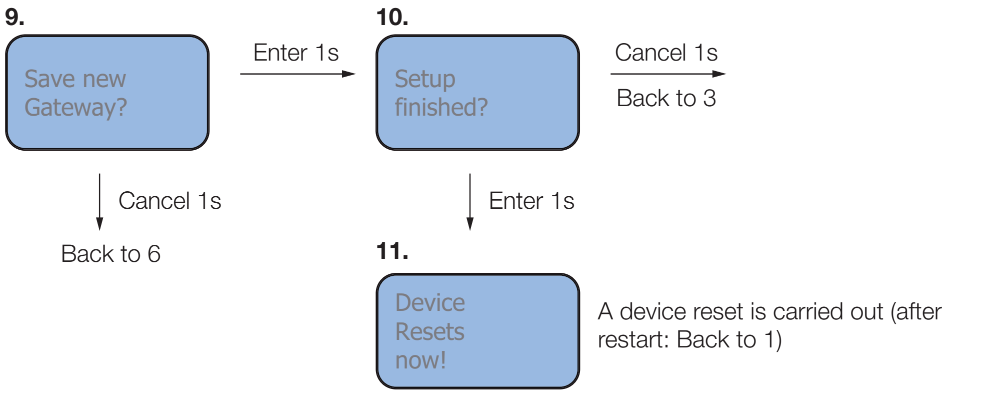


6 Function Indicators

6.11 Configuring the gateway address



- ▶ You can switch through the positions (1st, 2nd, 3rd) by pressing Enter/Down. The current position starts flashing.
- ▶ Press Cancel/Up to increase the number at the currently selected position.
- ▶ Press Enter (1s) to confirm the configured gateway address octet and switch to the next octet of the gateway address.
- ▶ Press Enter (1s) to confirm the configured gateway address in the 4th octet.



7 Commissioning

7.1 Supply voltage

To operate the processor unit, including read/write heads and IO-Link and I/O devices, only power is necessary.
External devices are powered by the processor unit. The supply voltage and power supply must meet the requirements of a *Limited Power Source* Class 2 (LPS Class 2) with a maximum output current of 8 A.

7.2 Startup using USB

Starting up the processor unit on a Windows PC:

1. Connect *Power* to a voltage source
   (see Section 5 Technical data and Section 4.3 Electrical connection).
   ⇒ LED RD lights up.
2. Connect USB port on the processor unit to a USB 1.1 compatible USB port on the PC.
3. Install driver *CDC Data Interface* for setting up a virtual *USB-COM port.*
4. Make USB connection through the virtual *USB-COM port*.
   ⇒ Active USB connection is indicated by the USB LED.

7.3 Driver installation

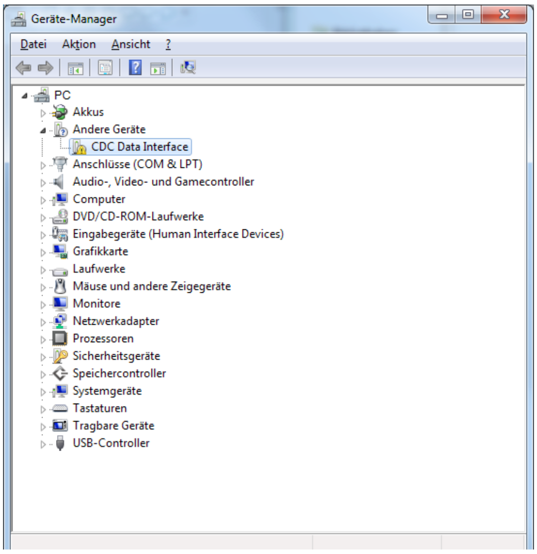
After connecting the BIS V to a USB port on the PC, Windows installs several drivers needed for operating the BIS V as a USB interchangeable data carrier. The *CDC Data Interface* driver may need to be installed manually.

Note
Administrator rights may be necessary for installing the driver.

Installation is described in the following for the Windows 7 operating system.

To open the Device Manager:

► *Start – Control Panel – Device Manager.*
⇒ The *Device Manager* window opens.



7 Commissioning

To open the device properties:

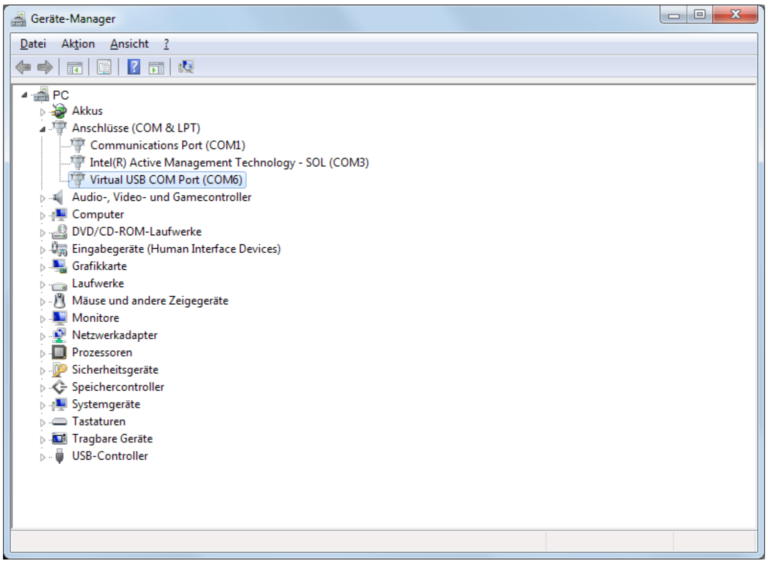
► Right-click on *CDC Data Interface – Properties*

To install:

1. *Change settings – Update drivers* .
2. Search for drivers on the computer.
3. After searching navigate to the directory *Driver* on the BIS V interchangeable data carrier.
4. Confirm by clicking *OK*.
5. Click on *Next* .

Note
Windows may show a warning for the driver signature.
The driver can still be installed with no risk.

After successful installation the virtual *USB-COM-Port* is displayed in the Device Manager.



7 Commissioning

Establish the USB connection

> **Tip**
> For quick startup the configuration software *BIS Cockpit* may also be used. This is available online at www.balluff.com.

The virtual *USB-COM-Port* can be used like a normal serial COM port.

Connect the PC, for example using a terminal program:

1. Connect USB ports on BIS V and PC.
2. Select virtual *USB-COM-Port.*
3. Set connection parameters *data rate, number of data bits, number of stop bits, parity* and *flow control*.
4. Make connection - open COM Port.

The standard parameters may be selected as follows:

Data rate:	230400 baud
Data bits:	8
Stop bits:	1
Parity:	None
Flow control:	None

> **Tip**
> The connection parameters have no meaning for the USB connection. Since the *USB-COM-Port* is not an actual COM port, e.g. in the sense of a serial RS-232 (or EIA-232) connection, the connection parameters are needed only for opening the COM port. The USB Full Speed connection parameters are used for the USB connection.

> **Note**
> The procedure for creating and opening a serial connection depends on the system used (PC, controller,...) and the programming language.
> ► Find details in the system documentation or programming language.

7.4 Startup using TCP/IP

Start up processor unit on the Windows PC:

1. Connect Power to a voltage source
   (see Section 5 Technical data and Section 4.3 Electrical connection).
   ⇒ LED **RD** comes on.
2. Connect TCP/IP ports (品) on the processor unit to an Ethernet port on the PC (physical).
   ⇒ The physical connection is indicated by illumination of the **L** (*Link*) LED.
   ⇒ If there is already data exchange taking place between BIS V and the PC, the **A** (*Activity*) light flashes.
3. Create and open TCP/IP-Socket with the parameters *IP address* and *TCP port*.
   ⇒ The active TCP/IP connection is indicated by the LED (品).

7 Commissioning

Open TCP/IP connection

Tip
For quick startup the configuration software *BIS Cockpit* may also be used. This is available online at www.balluff.com.

The BIS V communicates over Ethernet TCP/IP sockets with the higher level network. The BIS V is assigned an IP address by means of which the processor unit is accessed in the network. A fixed TCP port is used for communicating. By default a standard IP address is preset in the unit.

Standard network parameters:

IP address: 192.168.72.223

TCP port: 10001

Tip
To change the IP address and TCP port mode (single port, multi-port) and for opening a multi-socket connection, see Section 8 Parameter Configuration.

Note
The set IP address and IP mode (static, DHCP) can be queried and changed using the integrated display, see Section 6 Function indicators paragraph Display.

To open a TCP/IP socket you must define on which TCP port the socket connection is handled. The BIS V processor unit provides several ports for communication.

In single-port mode TCP port 10001 is used.
In multi-port mode ports 10001…10005 are used, see Section 8 Parameter Configuration.

Connect the PC, for example using an Ethernet terminal program:

1. Set the destination IP address.
   (BIS V default setting: 192.168.72.223)
2. Set TCP port used to handle the socket connection.
   (BIS V: Port 10001)
3. Open connection.

Note
The procedure for creating and opening a serial connection depends on the system used (PC, controller,...) and the programming language.

► Find details in the system documentation or programming language.

7 Commissioning

Keep-Alive function

In normal situations when the client is closed the connection to the BIS V should be properly closed as well. This allows the BIS V to shut itself down and enable the required resources.
If there is a “hard disconnection” of the connection between client and BIS V (e.g. client computer crash or failure of a network switch), the BIS V is not automatically notified of the connection break.
The keep-alive communication between server (BIS V) and client takes place in the stack and no keep-alive requires need to be responded to by the client application.
The server sends so-called “keep-alive” messages at regular intervals. The client confirms these without sending user data. If the client does not respond, the BIS V assumes that the connection is faulty and closes it.

The keep-alive function can be enabled or disabled through the web server and the message “SetKeepAliveConfiguration”.

8 Parameter Configuration

Various parameters can be used to affect the behavior of the identification system. A distinction is made here between net parameters, device parameters, RFID parameters and IO-Link parameters. This section lists the individual parameters as well as their entry values (shown in italics) and describes their function. The *underscored* entry values represent the factory default setting.

> **Note**
> Parameters are set using the configuration software *BIS Cockpit.* This is available online at www.balluff.com. Information for using can be found in the manual for the configuration software or the integrated help function.

8.1 Network Parameter

IP-Address

Specifies the IPv4 address at which the processor unit can be accessed in the network.

e.g. *197.168.72.223*

Subnet mask

Specifies the subnet mask used for network communication.

e.g. *255.255.255.0*

Standard-Gateway

Specifies the IP address of the standard gateway (optional).

e.g. *192.168.72.254*

IP-Mode

Specifies the address mode.

Static: The IP address defined with the parameter *IP address* is fixed.

DHCP: The IP address is automatically assigned by a higher level DHCP server.

> **Note**
> When manually assigning the IP address be sure that the IP address and subnet mask refer to the same subnet in which the network adapter and standard router are connected to the processor unit.

Keep-Alive

Determines whether the keep-alive mechanism is active.

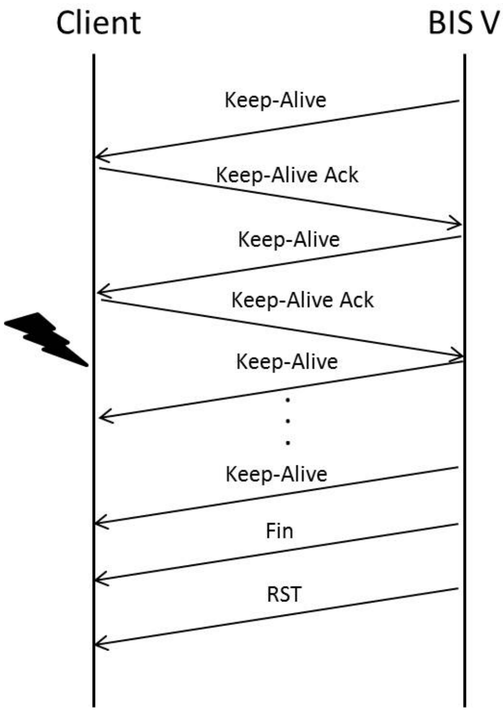
Enabled/Disabled

Keep-Alive Timeout

Determines the time interval (in seconds) at which a keep-alive request is sent.

e.g. *5*

8 Parameter setting



Note
If the keep-alive mechanism determines there is an open connection, all connections to this IP address are closed.

8 Parameter setting

8.2 Device Parameter

Display read-only

Enable or disable entries using the display keys (security function).

Enabled/*Disabled*

Device LEDs

Turns off/on all BIS V status LEDs (power-saving function).

Enabled/*Disabled*

TCP port Mode

Specifies how many TCP ports are used for the socket connection to the processor unit.

Single/*Multi* (see next page)

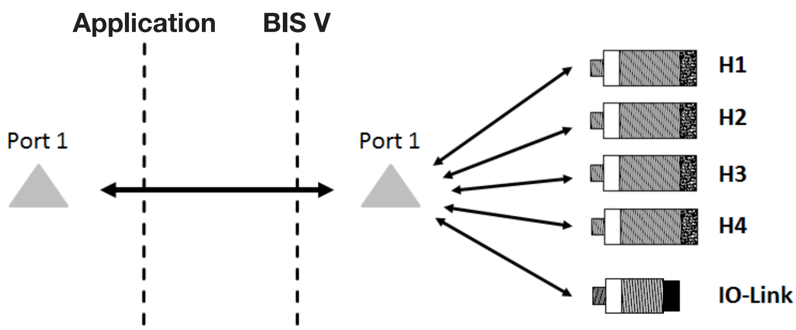
> **Note**
> Changes to the TCP Port Mode parameter only take effect after the processor unit is restarted.

Single-Port

Only one port is used for connecting to the processor unit.

H1…H4 + IO-Link: *Port 10001*

Application example 1
- Single-Port
- R/W heads H1…H4
- IO-Link



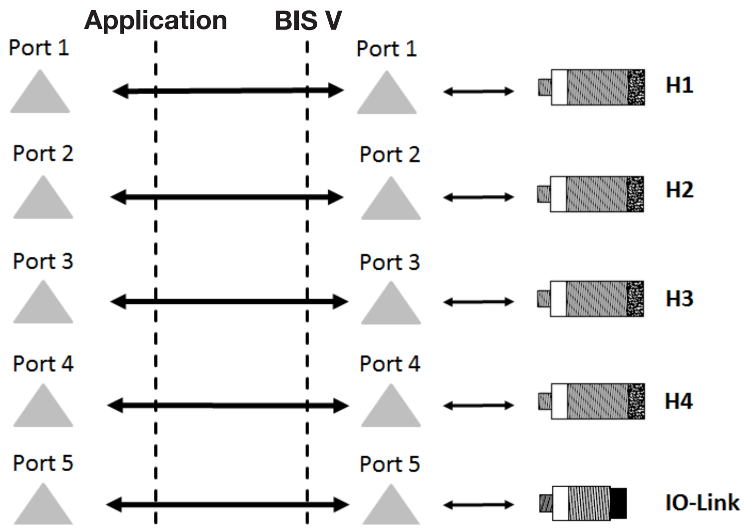
8 Parameter setting

Multi-Port

Separate TCP ports are used for the connections H1...H4 and IO-Link. The multi-port socket connection can be used to shorten access time in time-critical applications.

H1:	*Port 10001*
H2:	*Port 10002*
H3:	*Port 10003*
H4:	*Port 10004*
IO-Link:	*Port 10005*

Application example 2
- Multi-Port
- R/W heads H1…H4
- IO-Link



Read/write heads H1 to H4

Turn ports H1...H4 on/off
Enabled/Disabled

8 Parameter setting

8.3 RFID Parameter

CP status

If the *CP-Status* parameter is enabled, the processor unit reports asynchronously, i.e. without any prior request, when a data carrier enters the active field of the read/write head. Depending on the setting of the parameter *Type and serial number* the *UID* of the data carrier is returned or the memory contents of the specified auto-read range. This can be specified using the parameters *Auto-Read Start address* and *Auto-Read Length*.

Enabled/Disabled

> **Note**
> The function *CP-Status* is only supported in TCP/IP Multi-Port mode using series BIS VL, BIS VM and BIS C series read/write heads.

> **Note**
> In *Auto-Read* a status message is returned when the parameters *Auto-Read Start address* and *Auto-Read Length* are used to define a memory range invalid and not supported by the data carrier being used.

Auto-Read Start address

Specifies the start address from which to read in *Auto-Read* mode.

000000…999999

Auto-Read Length

Specifies the number of bytes which are read starting at the given *Auto-Read Start address* in *Auto-Read* mode.

0000…1024

> **Note**
> The Auto-Read function is not supported when using BIS-VU read/write heads.

Custom Parameter

Places the BIS V processor unit in BIS M-41_ _ compatibility mode for using custom read/write commands together with type BIS M-1_ _- 07 data carriers.

Enabled/Disabled

> **Note**
> In *Auto-Read* a status message is returned when the parameters *Auto-Read Start address* and *Auto-Read Length* are used to define a memory range invalid and not supported by the data carrier being used.

8 Parameter setting

Cyclic Redundancy Check

The CRC check is a procedure for determining a check value for data in order to be able to recognize transmission errors. If the CRC check is enabled, a status message will be sent when a CRC error is detected.

Enabled/Disabled

Note
The CRC check function is only supported by read/write heads in the BIS C, BIS VL, and BIS VM series.

Checksum

M and L system:
The checksum is written to the data carrier as 2 bytes of information. 2 bytes per block are lost. This leaves 14 bytes per block available. The usable number of bytes can be found in the following table.

C system:
The checksum is written to the data carrier as 2 bytes of information per page. 2 bytes per page are lost, i.e. the page size is 30 bytes or 62 bytes depending on the data carrier type.

The number of usable bytes thus decreases when using the checksum.

Balluff data carrier type	Memory capacity	Usable bytes for CRC_16
BIS M-1_ _-**01**	752 bytes	658 bytes
BIS M-1_ _-**02**	2000 bytes	1750 bytes
BIS M-1_ _-**03**	112 bytes	98 bytes
BIS M-1_ _-**04**	256 bytes	224 bytes
BIS M-1_ _-**05**	224 bytes	196 bytes
BIS M-1_ _-**06**	288 bytes	252 bytes
BIS M-1_ _-**07**	992 bytes	868 bytes
BIS M-1_ _-**08**	160 bytes	140 bytes
BIS M-1_ _-**09**	32 bytes	28 bytes
BIS M-1_ _-**10**	736 bytes	644 bytes
BIS M-1_ _-**11**	8192 bytes	7168 bytes
BIS M-1_ _-**13**	32786 bytes	28672 bytes
BIS M-1_ _-**14**	65536 bytes	57344 bytes
BIS M-1_ _-**15**	131072 bytes	114688 bytes
BIS M-1_ _-**20**	8192 bytes	7168 bytes
BIS M-1_ _-**21**	32 bytes	28 bytes
BIS M-1_ _-**22**	316 bytes	32 bytes
BIS M-1_ _-**23**	256 bytes	252 bytes
BIS L-1_ _-**01**	192 bytes	168 bytes
BIS L-2_ _-**03**	5 bytes (read-only)	–
BIS L-1_ _-**05**	192 bytes	168 bytes
BIS C-1_ _-**04**	511 bytes	450 bytes
BIS C-1_ _-**05**	1023 bytes	930 bytes
BIS C-1_ _-**11**	2047 bytes	1922 bytes
BIS C-1_ _-**32**	8192 bytes	7936 bytes

8 Parameter setting

Dynamic mode

As soon as the *Dynamic mode* function is enabled, the processor unit accepts the read/write job from the controlling system and stores it, regardless of whether a data carrier is in the active zone of the R/W head or not. If a data carrier enters the active range of the R/W head, the stored job is run.

Enabled/Disabled

> **Note**
> To achieve the read times during dynamic operation that are specified on page 110 the Tag Type parameter must be set to "BIS C 32 Byte" or "BIS C 64 Byte" on the respective head.

Tag type

Using the parameter *Tag Type* you can specify which data carrier types should be recognized by the processor unit. Other data carrier types are hidden by the processor unit. Selecting *All (Auto)* allows all data carrier types to be recognized.

- All (Auto)
- Mifare
- ISO 15693
- EM4x02
- Hitag1
- HitagS
- BIS C 32 byte
- BIS C 64 byte

When using R/W heads and data carriers of type BIS C you can achieve time optimization in dynamic mode by selecting the data carrier type, see Parameter *Dynamic mode*.

Type and Serial number

If this function is enabled, in Auto-Read instead of data the type of read/write head and data carrier type along with the serial number (UID = Unique Identifier) for the data carrier is read out. The data is output as soon as the data carrier is in the active zone of the read/write head. The CP bit is set in the input buffer.

The length of the outputted data is reduced to the configured buffer size as appropriate.

The length of the serial number can vary depending on the type of data carrier. To be able to determine the length, the data is preceded by a length field.

Enabled/Disabled

> **Note about BIS C**
> BIS C data carriers do not have serial numbers.

> **Note about BIS VM and BIS VL**
> BIS M and BIS L data carriers transfer a UID with a length of 4 bytes (e.g. Mifare and Hitag1) or a UID with a length of 8 bytes (ISO 15693) into the Serial Number field. Because of this, the data sheet for the data carrier used is to be followed.

> **Note about BIS VU**
> BIS U data carriers transfer EPC or TID into the Serial Number field, depending on the most recently executed command. For BIS VU, 00_{hex} is transferred by default into the data carrier type field.

Data format	2 bytes	2 bytes	2 bytes	Variable
Meaning	Length (number of bytes including length)	Read/write head type	Data carrier	Serial number

BIS VU-3_ _	BIS VM-3_ _-001-S4	BIS VL-3_ _-001-S4	BIS C-3_ _
'04'	'03'	'02'	'01'

Data carrier types
The following data carriers are available for the BIS V-6107 processor unit.

> **Note**
> The data carriers contain additional memory ranges for configuration and protected data. These ranges cannot be processed using the BIS V-6107 processor unit.

Mifare data carriers (for read/write heads BIS VM):

Balluff data carrier type	Manufacturer	Description	Memory capacity	Memory type
BIS M-1_ _-**01**	NXP	Mifare Classic	752 bytes	EEPROM
BIS M-1_ _-**10**	NXP	Mifare Classic	736 bytes	EEPROM

ISO 15693 data carriers (for read/write heads BIS VM):

Balluff data carrier type	Manufacturer	Description	Memory capacity	Memory type
BIS M-1_ _-**02**	Fujitsu	MB89R118	2000 bytes	FRAM
BIS M-1_ _-**03**	NXP	SL2ICS20	112 bytes	EEPROM
BIS M-1_ _-**04***	Texas Instruments	TAG-IT Plus	256 bytes	EEPROM
BIS M-1_ _-**05***	Infineon	SRF55V02P	224 bytes	EEPROM
BIS M-1_ _-**06***	EM	EM4135	288 bytes	EEPROM
BIS M-1_ _-**07**	Infineon	SRF55V10P	992 bytes	EEPROM
BIS M-1_ _-**08***	NXP	SL2ICS530	160 bytes	EEPROM
BIS M-1_ _-**09***	NXP	SL2ICS500	32 bytes	EEPROM
BIS M-1_ _-**11**	Balluff	BIS M-1	8192 bytes	FRAM
BIS M-1_ _-**13**	Balluff	BIS M-1	32768 bytes	FRAM
BIS M-1_ _-**14**	Balluff	BIS M-1	65536 bytes	FRAM
BIS M-1_ _-**15**	Balluff	BIS M-1	131072 bytes	FRAM
BIS M-1_ _-**20**	Fujitsu	MB89R112	8192 bytes	FRAM
BIS M-1_ _-**21**	Texas Instruments	RF37S114HT-FJB SLIX-L	32 bytes	EEPROM
BIS M-1_ _-**22**	NXP	SLIX-2	316 bytes	EEPROM
BIS M-1_ _-**23**	NXP	ICODE DNA SL256002	256 bytes	EEPROM

* On request

8 Parameter setting

For read/write heads BIS VL:

Balluff data carrier type	Manufacturer	Description	Memory capacity	Memory type
BIS L-1_ _-**01**	NXP	Hitag1	192 bytes	EEPROM
BIS L-2_ _-**03**	EM	EM4x02	5 bytes (read-only)	–
BIS L-1_ _-**05**	NXP	HitagS	192 bytes	EEPROM

For read/write heads BIS C (with adapter):

Balluff data carrier type	Manufacturer	Memory capacity	Memory type	Memory organization
BIS C-1_ _-**04**	Balluff	511 bytes	EEPROM	32-byte blocks
BIS C-1_ _-**05**	Balluff	1023 bytes	EEPROM	32-byte blocks
BIS C-1_ _-**11**	Balluff	2047 bytes	EEPROM	64-byte blocks
BIS C-1_ _-**32**	Balluff	8192 bytes	FRAM	64-byte blocks

Note
To achieve the read times for the BIS C read heads during dynamic operation that are specified on page 110 the Tag Type parameter must be set to "BIS C 32 Byte" or "BIS C 64 Byte“, see Parameter *Tag Type.*

For read/write heads BIS VU:

Balluff data carrier type	Manufacturer	Memory capacity
BIS U-1_ _	Balluff	See Data Sheet

Note
The read/write head BIS VU generally supports data carriers regardless of manufacturer, that meet the standards set by EPCglobal™ Class 1 Generation 2 or ISO IEC 18000-63.

Slow tag detection (only BIS VM)

Power saving function: In non-time-critical applications the data carrier detection can be slowed down. The data carrier detection is started at intervals of 200 ms. The field of the read/write head is turned off between queries.
Enabled/Disabled

Low power antenna (only BIS VM)

Power saving function: Read/write heads send at reduced transmitting power. This function is reserved for future read/write heads.
Enabled/Disabled

Note
Information about configuring the beam power for BIS VU read/write heads can be found in the manual for the BIS VU read/write head.
Manuals are available at www.balluff.com.

Head LEDs off

Power saving function: The status LEDs for the individual read/write heads can be turned off when they are not needed.
Enabled/Disabled

UID-compare-count (only BIS VL)

This parameter indicates how often the 5-byte ID of a BIS L-1_ _-03 data carrier is imported and compared before the data carrier is shown as identified. The value default setting is 2. For highly dynamic applications, this value can be set to 1.
– *2*
– *0…255*

8 Parameter setting

8.4 IO-Link Parameter

Cycle Time Base

Determines the cycle time base (milliseconds) with which the minimum cycle time of the IO-Link communication is calculated.

- *0.1 ms*
- *0.4 ms*
- *1.6 ms*

Cycle Time

Determines the multiplier used to calculate the minimum cycle time of the IO-Link communication. The factory default setting is 0 (Auto).

0…64

The minimum cycle time of IO-Link communication is set using the parameters *Cycle Time Base* and *Cycle Time* using the following equation:

Cycle Time_MIN = Cycle Time Base × Cycle Time

Note
The cycle time controls the timing for triggering the IO-Link device. It is stored in the IO-Link device and is automatically determined. Only times that are slower than the automatically selected times can be set manually. We therefore recommend keeping the factory default setting.

Parameter Server

The *Parameter Server* provides a data retention function by which the IO-Link specific parameter and (optionally) identification data are requested (upload) by a connected IO-Link device and can be sent (download) to it. This enables automated sending of parameter data, for example when replacing an IO-Link device.

- *Enabled*: Enables data retention
- *Disabled*: Disables data retention, stored data are retained
- *Deleted*: Disables data retention, stored data are deleted

Note
To be able to use the *Parameter Server* function the IO-Link master and IO-Link device must meet IO-Link specification v1.1 or higher.
The *Parameter Upload* and *Parameter Download* parameters must be enabled.

Parameter Upload

Specifies whether parameter and identification data should be requested by the IO-Link device.

- *Enabled*: The IO-Link master starts an upload of the parameter data as soon as an IO-Link device requests an upload (Upload flag set) or when no data are stored in the master port (e.g. after deleting the data or before the first data upload).
- *Disabled*: The IO-Link master does not start a Parameter Upload. When there is an Upload request from the IO-Link device a download is started (if enabled) if there are different parameter sets).

Parameter Download

Specifies whether parameter and identification data should sent from the IO-Link master to the IO-Link device.

- *Enabled*: If an IO-Link device is connected whose parameters are different from those stored in the *Parameter Server* a download is started as long as there is no Upload request by the IO-Link device.
- *Disabled*: The IO-Link master does not start a *Parameter Download*. If *Parameter Upload* is enabled, it is carried out regardless of the Upload flag in the IO-Link device.

8 Parameter setting

Validation

Specifies whether the parameter data for a connected IO-Link device are checked after connecting.
If this function is enabled, IO-Link communication is only started of the parameter data for the IO-Link device agree with those of the *Parameter Server*.

- *Disabled*: No validation is performed, all IO-Link devices are accepted.
- *Compatible*: *VendorID* and *DeviceID* are checked. The IO-Link communication is only started if there is a match.
- *Identical*: *VendorID*, *DeviceID* and *Serial* are checked. The IO-Link communication is only started if there is a match.

Note
After the upload of the parameter data, the *VendorID* and *DeviceID* of the connected IO-Link device are also still saved until the data records are deleted.
When the connected IO-Link device is started and validation is enabled, the parameter data are checked. Thus, only an IO-Link device of the same type can be used for the data retention.

Input Length

Specifies the number of bytes used for the input process data.

0…32

Output Length

Specifies the number of bytes used for the output process data.

0…32

Tip
The process data length specified with the parameters *Input Length* and *Output Length* must agree with that of the connected IO-Link device. The process data length to use can be found in the manual for the IO-Link device.

Port Function 1

Specifies the function of Pin 2 of the IO-Link port. This can be operated as a standard input/output (SIO) in various operating modes.

- *Input as normally open contact (NO)*
- *Input as normally closed contact (NC)*
- *Output*

Port Function 2

Specifies the function of Pin 4 of the IO-Link port. This can be operated optionally for IO-Link communication and as a standard input/output (SIO) in various operating modes.

- *Input as normally open contact (NO)*
- *Input as normally closed contact (NC)*
- *Output*
- *IO-Link communication*
- *IO-Link input as normally open contact with SIO function*
- *IO-Link input as normally closed contact with SIO function*

VendorID

Specifies the vendor ID which is stored in the IO-Link master. The Vendor ID is used with validation for the function *Parameter Server*, see Parameter *Parameter Server* and *Validation* in this section.

'0000'

8 Parameter setting

DeviceID

Specifies the Device ID which is stored in the IO-Link master. The Device ID is used with validation for the function *Parameter Server*, see Parameter *Parameter Server* and *Validation* in this section.

'000000'

Serial

Specifies the serial number (16-byte ASCII coded) which is stored in the IO-Link master. The serial number is used with validation for the function *Parameter Server*, see Parameter *Parameter Server* and *Validation* in this section.

'0000000000000000'

9 Protocol

Either a USB 1.1 or Ethernet TCP/IP connection can be used for communication between the processor unit and the controlling system. Full, errorless and sequenced data transmission is assured by the USB or Ethernet transmission channel.

Note
The procedure for creating and opening a TCP/IP socket connection or a USB connection using a virtual *COM-Port* depends on the system used (PC, controller,...) and the programming language.

► Find details in the system documentation or programming language.

For orientation Section 7 Commissioning can be referred to.

9.1 Protocol Sequence

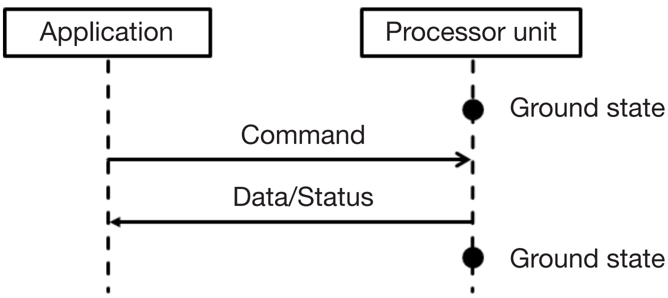
The protocol is based on synchronous commands which are constructed according to the *Request – Reply* principle. This means for every correct request the controller receives a corresponding reply which can contain the data or a status message.

► Use the sequence described in this section.

All deviating inputs are ignored by the processor unit. After complete processing or canceling of a command the processor unit automatically returns to its base state.

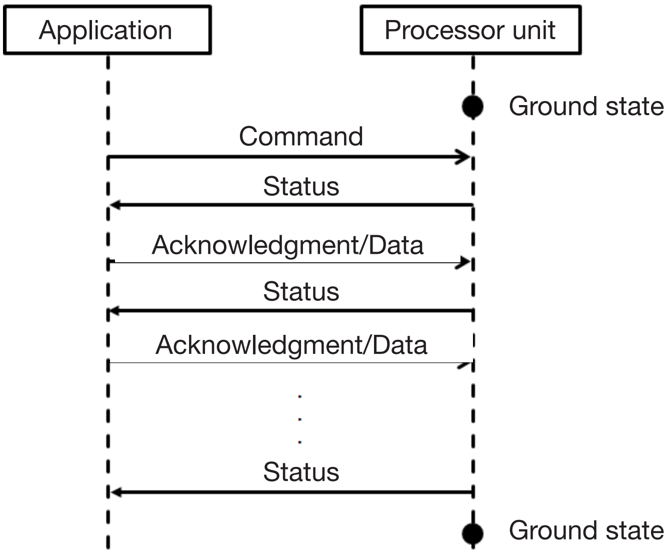
Note
The only exception which deviates from the *Request – Reply* principle is the asynchronous *CP-Status*-message, which is sent to the controller without having to be requested.
This function must be enabled by the parameter *CP-Status*, see *CP-Status* Section 8 Parameter Configuration.

Single-level commands are carried out according to the principle
Base state – Request – Reply – Base state:



9 Protocol

Multi-level commands are carried out according to the principle
Base state – Request – Reply – Acknowledgment/Data – Reply – … – Base state :



Tip
Multi-level commands can be canceled by the controller using the Quit command (command designator 'Q') after each received reply.
The processor unit then returns to the base state and waits for input.

9.2 Control characters

The following control characters are used for protocol control and output of status messages.

Control characters	HEX	Description	Function/Direction	Meaning
<STX>	02	Start of Text	Control/Request	Protocol control for multi-level commands and requesting data
<EOT>	04	End of Transmission	Control/Reply	Protocol control for multi-level commands and naming the last data frame
<ACK>	06	Acknowledge	Status/Reply	Request successful
<NAK>	15	Negative Acknowledge	Status/Reply	Request unsuccessful, check status number

9 Protocol

9.3 Block Check Character (BCC)

In addition to the mechanisms for data transmission verification provided by USB and TCP/IP, the user data can be verified using a simple *Block Check Character* (BCC). The BCC is formed using simple EXOR operations on all bytes to be sent and is appended to the end of the commands. To check whether data were correctly received, the BCC for the received data can be rechecked and compared with the received BCC. If there is agreement it can be assumed that the data are correct.

The BCC is calculated according to the following principle:

Result	Operand 1	Operator	Operand 2
AKKU(1)	Data_Byte(1)	EXOR	00_{hex}
AKKU(2)	Data_Byte(2)	EXOR	AKKU(1)
…	…	…	…
AKKU(n-1)	Data_Byte(n-1)	EXOR	AKKU(n-2)
BCC	Data_Byte(n)	EXOR	AKKU(n-1)

Example: Read EPC data from data carrier at read/write head 1
(Command *Read data carrier, EPC*)

Command:

ASCII	HEX
'O1' BCC	$4F_{hex}31_{hex}BCC_{hex}$

Calculation:

Result	Operand 1	Operator	Operand 2
$4F_{hex}$	$4F_{hex}$	EXOR	00_{hex}
$7E_{hex}$ (BCC)	31_{hex}	EXOR	$4F_{hex}$

Data to send:

ASCII	HEX
'O1~'	$4F_{hex}31_{hex}7E_{hex}$

The following code section shows how the calculation could be done in C language:

```
char CalculateBcc(char* messageBytes, int countOfBytes)
{
     int loopCount = 0;
     char bccValue = 0x00;
     for(loopCount = 0; loopCount < countOfBytes; loopCount++)
     {
          bccValue = bccValue ^ messageBytes[loopCount];
     }
     return bccValue;
}
```

9 Protocol

9.4 Data format EPC/TID

EPC and TID data are sent in blocks of 64 bytes. The length field (1 byte) indicates what length the EPC and TID data have (max. 62 bytes). The block may need to be filled flush left with zeros. The EPC and TID are output in reverse order with leading zeros (left flush)

Structure:

1st byte	2nd byte	3rd…64th bytes
Length	Reserved	EPC/TID data

Example:
EPC: 01 02 06 05 04 03 02 02 08 09 0A 0B ; Length 12 bytes

$0C_{hex}$, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex},
00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex},
00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex},
00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex},
00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex},
00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, 00_{hex},
00_{hex}, 00_{hex}, 00_{hex}, 00_{hex}, $0B_{hex}$, $0A_{hex}$, 09_{hex}, 08_{hex},
02_{hex}, 02_{hex}, 03_{hex}, 04_{hex}, 05_{hex}, 06_{hex}, 02_{hex}, 01_{hex}

9.5 Command overview

Global commands

Function	Command designator		Description
	ASCII	HEX	
Abort	'Q'	51_{hex}	Cancel multi-level commands
Initialize CRC-16 data check	'Z'	$5A_{hex}$	Initialize data carrier for CRC-16 data check Number of bytes: 0…1024 bytes
Initialize CRC-16 data check, expanded	'&'	26_{hex}	Initialize data carrier for CRC-16 data check Number of bytes: > 1024
Read data carrier	'L'	$4C_{hex}$	Read data from data carrier Number of bytes: 0…1024 bytes
Read data carrier, expanded	'H'	48_{hex}	Read data from data carrier Number of bytes: > 1024 bytes
Write to data carrier	'P'	50_{hex}	Write to data carrier Number of bytes: 0…1024 bytes
Write to data carrier, expanded	'F'	46_{hex}	Write to data carrier Number of bytes: > 1024 bytes
Write to data carrier, constant value	'C'	43_{hex}	Write constant data to data carrier
Display output	'd'	64_{hex}	Output characters on the display
Copy data between data carriers	'c'	63_{hex}	Copy data between data carriers, e.g. write data of data carrier at R/W head 1 to data carrier at R/W head 2
Reset Read/write head	'q'	71_{hex}	Restart read/write head

9 Protocol

Global commands

Function	Command designator		Description
	ASCII	HEX	
Type and serial number	'A'	41_{hex}	Query information for a selected R/W head – Type of connected R/W head – Type of data carrier at R/W head – UID/EPC/TID of the data carrier
Type and status	'U'	55_{hex}	Query information for all R/W heads (H1…H4) – Type of connected R/W head – R/W head and tag status – Type of data carrier at R/W head (binary coded) – UID/EPC/TID of the data carrier (binary coded)
Type and status ASCII	'u'	75_{hex}	Query information for all R/W heads (H1…H4) – Type of connected R/W head – R/W head and tag status – Type of data carrier at R/W head (ASCII coded) – UID/EPC/TID of the data carrier (ASCII coded)
Read version	'V'	56_{hex}	Query information for processor unit and connected R/W heads – BIS V type designation – Hardware/Firmware Version/Serial Number – IO-Link FW- version
Custom Parameter	'$'	24_{hex}	Set/reset custom parameter value
Keep-alive, set	'%'	25_{hex}	Set/reset keep-alive parameter
Keep-alive, read	'='	$3D_{hex}$	Read keep-alive parameter

IO-Link specific commands

Function	Command designator		Description
	ASCII	HEX	
Digital input, read	'*'	$2A_{hex}$	Query status of Pin 2 and Pin 4 if they are operated as digital inputs
Digital output, set	'/'	$2F_{hex}$	Set/reset Pin 2 and Pin 4 if they are used as digital outputs
Read parameter data	'i'	69_{hex}	Read IO-Link device parameter data
Read cyclical process data	'Y'	59_{hex}	Read cyclical IO-Link process data
Write parameter data	'e'	65_{hex}	Write IO-Link device parameter data
Write cyclical process data	'X'	58_{hex}	Write cyclical IO-Link process data

9 Protocol

BIS VU specific commands

Function	Command designator		Description
	ASCII	HEX	
No. of tags	'N'	$4E_{hex}$	Query the number of tags located in the range of the specified UHF R/W head
Detecting data carriers	'M'	$4D_{hex}$	Detects the data carriers which are at the specified R/W head and returns a list of the EPC/TID data
Read data carrier, bulk	'I'	49_{hex}	Detects the data carriers which are at the specified R/W head and returns a list of the USER data
Read data carrier, EPC	'O'	$4F_{hex}$	Read the EPC memory range of a selected data carrier
Read data carrier, TID	'y'	79_{hex}	Read the TID memory range of a selected data carrier
Write to data carrier, bulk	'w'	77_{hex}	Write USER data to data carriers which are in the range of the specified R/W head
Write to data carrier, EPC	'v'	76_{hex}	Write to the EPC memory range of a selected data carrier
Kill	'k'	$6B_{hex}$	Disables a selected data carrier permanently (irreversible)
Lock	'l'	$6C_{hex}$	Locks memory ranges of a selected data carrier
Read parameters	'G'	47_{hex}	Reads parameter data of the selected R/W head
Write parameters	'E'	45_{hex}	Reads parameter data of the selected R/W head
Read RSSI	'r'	72_{hex}	Queries the RSSI value at the selected R/W head
Select	'z'	$7A_{hex}$	Selects a specified data carrier within a data carrier population
Read beam power	'o'	$6F_{hex}$	Queries the current set beam power of the selected R/W head
Write beam power	'p'	70_{hex}	Specifies the beam power of the specified R/W head
Unselect	'n'	$6E_{hex}$	Deselects the specified data carrier, see command *Select*

9 Protocol

9.6 Status numbers

Status number		Function description
'0'	00_{hex}	Everything OK
'1'	31_{hex}	Job cannot be run because there is no data carrier in range of the read/write head.
'2'	32_{hex}	Cannot read the data carrier.
'3'	33_{hex}	Data carrier was removed from the R/W head's range during writing.
'4'	34_{hex}	Cannot write to the data carrier.
'5'	35_{hex}	Data carrier was removed from the R/W head's range during writing.
'7'	37_{hex}	007- protocol error
'8'	38_{hex}	BCC error
'9'	39_{hex}	R/W head cable break or no R/W head connected.
'A'	41_{hex}	More than 1 data carrier is in the R/W head's field
'E'	45_{hex}	CRC for the read data and CRC for the data carrier do not agree.
'S'	53_{hex}	Command is no longer supported.
'P'	50_{hex}	Only possible in multi-mode, a head was selected using the wrong port
'a'	61_{hex}	This function is not possible for this data carrier.
'b'	62_{hex}	License key incorrect.
'c'	63_{hex}	Invalid parameter set.
'd'	64_{hex}	Communication to the R/W head disrupted.
'e'	65_{hex}	Address assignment of the read/write job is outside the memory range of the data carrier.
'f'	66_{hex}	Password required.
'g'	67_{hex}	Password invalid.
'h'	68_{hex}	Memory area is locked.
'i'	69_{hex}	Parameter value range incorrect
'j'	$6a_{hex}$	No or wrong data carrier selected.

9 Protocol

9.7 Description of global commands

Command ID 'Q': Cancel

► Cancel multi-level commands.

A cancel is possible after receipt of any reply. The processor unit returns to the base state after cancel.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'Q'
01	1	BCC	00_{hex}...FF_{hex}

Status message:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

9 Protocol

Command ID 'Z': CRC-16 initialize data check

- ► The memory area of the data carrier used is prepared for use with a CRC data check. It is initialized by writing USER data with a checksum.
- ► The number of initialized data is limited to 1024 bytes. For larger data blocks use the command *Initialize CRC-16 data check, expanded*.

Note
If the CRC data check is enabled in the processor unit, then read and write commands on a memory area that is not initialized leads to a CRC error.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'Z'
01	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Start address (ASCII) low byte	'0'…'9'
07	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
12	1	Number of bytes (ASCII) low byte	'0'…'9'
13	1	Head number (ASCII)	'1'…'4'
14	1	Reserve (ASCII)	'R'
15	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows and the command is carried out:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

Command ID '&': CRC-16 Initialize data check, expanded

► Writes USER data at the specified start address. The data length is equal to the number of bytes.

► For jobs > 1024 bytes this command is required. The data are divided into several data blocks and a single data block may contain maximum 1024 bytes.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'&'
01	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Start address (ASCII) low byte	'0'…'9'
07	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
12	1	Number of bytes (ASCII) low byte	'0'…'9'
13	1	Head number (ASCII)	'1'…'4'
14	1	Reserve (ASCII)	R
15	1	BCC	

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows with the first data block.

'0'…'9'	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Number of bytes (ASCII) low byte	'0'…'9'
07	1	Data	
…	…	Data	
Last byte	1	BCC	

Command ID 'L': Read data carrier

- ► Reads USER data from the specified start address. The data length is equal to the number of bytes.
- ► The number of read data is limited to 1024 bytes. For larger data block use the command *Read data carrier, expanded* .

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'L'
01	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Start address (ASCII) low byte	'0'…'9'
07	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
12	1	Number of bytes (ASCII) low byte	'0'…'9'
13	1	Head number (ASCII)	'1'…'4'
14	1	Reserve (ASCII)	'R'
15	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Data block	00_{hex}…FF_{hex}
15	1	BCC	00_{hex}…FF_{hex}

9 Protocol

Command ID 'H': Read data carrier, expanded (> 1024 bytes)

- ► Reads USER data from the specified start address. The data length is equal to the number of bytes. For jobs > 1024 bytes this read command is needed.
- ► The data are divided into data blocks of maximum 1024 bytes each.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'H'
01	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Start address (ASCII) low byte	'0'…'9'
07	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
12	1	Number of bytes (ASCII) low byte	'0'…'9'
13	1	Head number (ASCII)	'1'…'4'
14	1	Reserve (ASCII)	'R'
15	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
03	1	Number of bytes (ASCII) low byte	'0'…'9'
04	1	Packet number (ASCII) high byte (ASCII)	'0'…'9'
…	…	…	'0'…'9'
06	1	Packet number (ASCII) low byte (ASCII)	'0'…'9'
07	6	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
…	…	…	'0'…'9'
…	…	…	'0'…'9'
13	1	Data	00_{hex}…FF_{hex}
…	…	Data	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

or:

Byte	Length	Command element	Value range
00	1	Status	<NAK>
01	1	Status number	See Status Number table

9 Protocol

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

Acknowledgment for the last data packet:

Byte	Length	Command element	Value range
00	1	Status	<EOT>
01	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
03	1	Number of bytes (ASCII) low byte	'0'…'9'
04	1	Packet number (ASCII) high byte (ASCII)	'0'…'9'
…	…	…	'0'…'9'
06	1	Packet number (ASCII) low byte (ASCII)	'0'…'9'
07	6	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
…	…	…	'0'…'9'
…	…	…	'0'…'9'
13	1	Data	00_{hex}…FF_{hex}
…	…	Data	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

9 Protocol

Command ID 'P': Write data carrier

- Writes USER data at the specified start address. The data length is equal to the number of bytes.
- The number of write data is limited to 1024 bytes. For larger data blocks use the command *Write data carrier, expanded* .

Note
A password is required to write to read-only data carriers. Write commands that are attempted with an invalid password will be acknowledged with the status message *Password Required* or *Password Invalid*.

- For details about access passwords refer to the manual for the UHF read/write head.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'P'
01	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Start address (ASCII) low byte	'0'…'9'
07	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
12	1	Number of bytes (ASCII) low byte	'0'…'9'
13	1	Head number (ASCII)	'1'…'4'
14	1	Reserve (ASCII)	'R'
15	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows with the data block. Length of the data block is the desired number of bytes (n).

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

Command ID 'F': Write data carrier; Expanded

- Writes USER data at the specified start address. The data length is equal to the number of bytes. For jobs > 1024 bytes this write command is needed.
- The data are divided into data blocks of maximum 1024 bytes each.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'F'
01	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Start address (ASCII) low byte	'0'…'9'
07	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
12	1	Number of bytes (ASCII) low byte	'0'…'9'
13	1	Head number (ASCII)	'1'…'4'
14	1	Reserve (ASCII)	'R'
15	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows with the data block:

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Number of bytes (ASCII) low byte	'0'…'9'
07	1	Data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

9 Protocol

After a successful acknowledgment the data blocks are sent until the required number of blocks has been reached.

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Number of bytes (ASCII) low byte	'0'…'9'
07	1	Data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Command ID 'C': Write data carrier, constant value

► Writes a constant value to the memory area, which is indicated with a start address and number of bytes.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'C'
01	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Start address (ASCII) low byte	'0'…'9'
07	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
12	1	Number of bytes (ASCII) low byte	'0'…'9'
13	1	Head number (ASCII)	'1'…'4'
14	1	Reserve (ASCII)	'R'
15	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The constant value is then sent:

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Value that is to be written to the data carrier.	00_{hex}…FF_{hex}
02	1	BCC	00_{hex}…FF_{hex}

Note
Details and more information about the available parameters as well as BIS VU-specific commands can be found in the manual of the BIS VU read/write head used (available at www.balluff.com)

9 Protocol

Command ID 'd': Display output

► Output of a predetermined character string on the display.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'd'
01	1	Number of characters (ASCII) high byte	'0'…'9'
02	1	Number of characters (ASCII) low byte	'0'…'9'
03	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table
02	1	BCC	00_{hex}…FF_{hex}

After a successful acknowledgment the characters are sent until the required number of bytes has been reached.

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Characters (ASCII)	00_{hex}…FF_{hex}
…	…	Characters (ASCII)	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Command ID 'c': Copy data between data carriers

► Copy data from one data carrier to another.

The specified number of bytes will be copied from the source start address in the source data carrier to the target start address in the target data carrier. Care must be taken to ensure that the memory areas of the source and target data carriers are compatible.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'c'
01	1	Source start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Source start address (ASCII) low byte	'0'…'9'
07	1	Target start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
12	1	Target start address (ASCII) low byte	'0'…'9'
13	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
18	1	Number of bytes (ASCII) low byte	'0'…'9'
19	1	Source head number (ASCII)	'1'…'4'
20	1	Target head number (ASCII)	'1'…'4'
21	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows and the command is carried out:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

New acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

9 Protocol

Command ID 'q': Reset Read/write head

► Restarts the selected read/write head.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'q'
01	1	Head number (ASCII)	'1'…'4'
02	1	BCC	00_{hex}…FF_{hex}

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table
02	1	BCC	00_{hex}…FF_{hex}

Command ID 'A': Type and serial number

► Read read/write head as well as data carrier type and UID of a data carrier located in the field.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'A'
01	1	Head number (ASCII)	'1'…'4'
02	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of bytes (ASCII) high byte	'0'…'9'
03	1	Number of bytes (ASCII) low byte	'0'…'9'
4	1	Data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Note
The format of the returned data is described in Section 8 Parameter Configuration, see Parameter *Type and Serial number.*

Note
BIS C data carrier do not carry data carrier type information.
For BIS U data carrier the command with the command identifier 'M' is suitable.

Example data block:

Byte	Data	Description
00, 01	30_{hex}, 33_{hex}	Read/write head type: '03'
02, 03	30_{hex}, 32_{hex}	Data carrier type: '02'
04…11	$E0_{hex}$, 08_{hex}, 01_{hex}, 13_{hex}, $8C_{hex}$, $A2_{hex}$, $D1_{hex}$, $A2_{hex}$	UID

9 Protocol

Command ID 'U': Type and Status

► Query information for all R/W heads (H1…H4)

- Type of connected R/W head
- R/W head and tag status
- Type of data carrier at R/W head
- UID/EPC/TID of the data carrier

If the ID of the tag used is < 8 bytes, the UID is filled with zeros so that they come at the end. If there is no tag or more than one tag at the corresponding head, only 8 zeros are sent.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'U'
01	1	BCC	

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Data	
01	1	Data	
…	…	Data	
Last byte	1	BCC	

9 Protocol

The data have the following format:

Length	Meaning	Function description
1	Head 1 status	Status of the 1st head: '0': Tag there '1': No tag '9': No head
1	Head 1 type	'1': C-Type '2': L-Type '3': M-Type '4': U-Type
1	Head 1 tag type	
1	Head 1 tag ID [0]	
…		
1	Head 1 tag ID [7]	
1	Head 2 status	Status of the 2nd head: '0': Tag there '1': No tag '9': No head
1	Head 2 type	'1': C-Type '2': L-Type '3': M-Type '4': U-Type
1	Head 2 tag type	
1	Head 2 tag ID [0]	
…		
1	Head 2 tag ID [7]	
1	Head 3 status	Status of the 3rd head: '0': Tag there '1': No tag '9': No head
1	Head 3 type	'1': C-Type '2': L-Type '3': M-Type '4': U-Type
1	Head 3 tag type	
1	Head 3 tag ID [0]	
…		
1	Head 3 tag ID [7]	
1	Head 4 status	Status of the 4th head: '0': Tag there '1': No tag '9': No head
1	Head 4 type	'1': C-Type '2': L-Type '3': M-Type '4': U-Type

9 Protocol

Command ID 'u': Type and Status ASCII

► Query information for all R/W heads (H1…H4)

- Type of connected R/W head
- R/W head and tag status
- Type of data carrier at R/W head
- UID/EPC/TID of the data carrier

If the ID of the tag used is < 8 bytes, the UID is filled with zeros so that they come at the end. If there is no tag or more than one tag at the corresponding head, only 8 zeros are sent.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'u'
01	1	BCC	

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Data	
01	1	Data	
…	…	Data	
Last byte	1	BCC	

9 Protocol

The data have the following format:

Length	Meaning	Function description
1	<CR>	
1	<LF>	
1	Head 1 status	Status of the 1st head: '0': Tag there '1': No tag '9': No head
	Hyphen	'-'
1	Head 1 type (low byte)	'01': C-Type '02': L-Type '03': M-Type '04': U-Type
1	Head 1 type (high byte)	
	Hyphen	'-'
1	Head 1 tag type (low byte)	Tag type in ASCII
1	Head 1 tag type (high byte)	Tag type in ASCII
	Hyphen	'-'
1	Head 1 tag ID [0]	Tag ID in ASCII
…		
1	Head 1 tag ID [15]	Tag ID in ASCII
1	<CR>	
1	<LF>	
1	Head 2 status	Status of the 2nd head: '0': Tag there '1': No tag '9': No head
	Hyphen	'-'
1	Head 2 type (low byte)	'01': C-Type '02': L-Type '03': M-Type '04': U-Type
1	Head 2 type (high byte)	
	Hyphen	'-'
1	Head 2 tag type (low byte)	Tag type in ASCII
1	Head 2 tag type (high byte)	Tag type in ASCII
	Hyphen	'-'
1	Head 2 tag ID [0]	Tag ID in ASCII
…		
1	Head 2 tag ID [15]	Tag ID in ASCII
1	<CR>	
1	<LF>	
1	Head 3 status	Status of the 3rd head: '0': Tag there '1': No tag '9': No head
	Hyphen	'-'

9 Protocol

Length	Meaning	Function description
1	Head 3 type (low byte)	'01': C-Type '02': L-Type '03': M-Type '04': U-Type
1	Head 3 type (high byte)	
	Hyphen	'-'
1	Head 3 tag type (low byte)	Tag type in ASCII
1	Head 3 tag type (high byte)	Tag type in ASCII
	Hyphen	'-'
1	Head 3 tag ID [0]	Tag ID in ASCII
…		
1	Head 3 tag ID [15]	Tag ID in ASCII
1	<CR>	
1	<LF>	
1	Head 4 status	Status of the 4th head: '0': Tag there '1': No tag '9': No head
	Hyphen	'-'
1	Head 4 type (low byte)	'01': C-Type '02': L-Type '03': M-Type '04': U-Type
1	Head 4 type (high byte)	
	Hyphen	'-'
1	Head 4 tag type (low byte)	Tag type in ASCII
1	Head 4 tag type (high byte)	Tag type in ASCII
	Hyphen	'-'
1	Head 4 tag ID [0]	Tag ID in ASCII
…		
1	Head 4 tag ID [15]	Tag ID in ASCII

9 Protocol

Command ID 'V': Read version

► One line is output for the processor unit and each R/W head. This shows the product name, firmware version, hardware version and serial number. Unconnected heads are indicated by "no head".

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'V'
01	1	BCC	$00_{hex}…FF_{hex}$

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Version data (ASCII)	$00_{hex}…FF_{hex}$
01	1	Version data (ASCII)	$00_{hex}…FF_{hex}$
…	…	…	$00_{hex}…FF_{hex}$
Last byte	1	BCC	$00_{hex}…FF_{hex}$

9.8 Description of IO-Link specific commands

Command ID '*': Digital input, read

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'*'
01	1	IO-Link Pin (ASCII)	'2': Pin 2 '4': Pin 4
02	1	BCC	00_{hex}...FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Value (ASCII)	'0': On '1': Off
02	1	BCC	00_{hex}...FF_{hex}

Command ID '/': Digital output, set

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'/'
01	1	IO-Link Pin (ASCII)	'2': Pin 2 '4': Pin 4
02	1	Value (ASCII)	'0': On '1': Off
03	1	BCC	00_{hex}...FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

9 Protocol

Command ID 'i': Read parameter data

► Read the IO-Link parameters.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'i'
01	1	Index (ASCII hex) high byte	'0'…'F'
…	…	…	'0'…'F'
04	1	Index (ASCII hex l) low byte	'0'…'F'
05	1	Sub-Index (ASCII hex) high byte	'0'…'F'
…	…	…	'0'…'F'
08	1	Sub-Index (ASCII hex) low byte	'0'…'F'
09	1	BCC	$00_{hex}…FF_{hex}$

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Number of bytes (ASCII) high byte	'0'…'9'
02	1	Number of bytes (ASCII) low byte	'0'…'9'
03	1	Data	$00_{hex}…FF_{hex}$
…	…	…	$00_{hex}…FF_{hex}$
Last byte	1	BCC	$00_{hex}…FF_{hex}$

9 Protocol

Command ID 'Y': Read cyclical process data

► Write IO-Link process data.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'Y'
01	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
03	1	Start address (ASCII) low byte	'0'…'9'
04	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Number of bytes (ASCII) low byte	'0'…'9'
07	1	BCC	$00_{hex}…FF_{hex}$

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Number of bytes (ASCII) high byte	'0'…'9'
02	1	Number of bytes (ASCII) low byte	'0'…'9'
03	1	Data	$00_{hex}…FF_{hex}$
…	…	…	$00_{hex}…FF_{hex}$
Last byte	1	BCC	$00_{hex}…FF_{hex}$

9 Protocol

Command ID 'e': Write parameter data

► Writes IO-Link parameters.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'e'
01	1	Index (ASCII hex) high byte	'0'…'F'
…	…	…	'0'…'F'
04	1	Index (ASCII hex) low byte	'0'…'F'
05	1	Sub-Index (ASCII hex) high byte	'0'…'F'
…	…	…	'0'…'F'
08	1	Sub-Index (ASCII hex) low byte	'0'…'F'
09	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
11	1	Number of bytes (ASCII) low byte	'0'…'9'
12	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows with the data block. Length of the data block is the desired number of bytes (n).

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

Command ID 'X': Write cyclical process data

► Write IO-Link process data.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'X'
01	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
03	1	Start address (ASCII) low byte	'0'…'9'
04	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Number of bytes (ASCII) low byte	'0'…'9'
07	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows with the data block. Length of the data block is the desired number of bytes (n).

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

9 Protocol

9.9 Description of BIS VU specific commands

Note
Detailed information about the function of read/write head series BIS VU* can be found in the manual for the read/write head.

Command ID 'N': Number of tags

► This command returns the number of data carriers that were found in the active read/write zone of the antenna. Optionally, the total number of data carriers or the number of data carriers selected with the *Select* command.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'N'
01	1	Head number (ASCII)	'1'…'4'
02	1	Data carrier selection	'0': All '1': Selected
03	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

The reply then follows with the first data block.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of data carriers read (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
04	1	Number of data carriers read (ASCII) low byte	'0'…'9'
05	1	BCC	00_{hex}…FF_{hex}

Command ID 'M': Read data carriers

- The *Read from Multiple Data Carriers* reads, depending on the configured type, the EPC or the TID of all data carriers that are located in the active read/write area of the antenna. The EPC and TID are output in reverse order with leading zeros.
- The data length of a packet is maximum 1188 bytes.

Note
The length of the TID or EPC field parameters are configured on the BIS VU read/write head.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'M'
01	1	Head number (ASCII)	'1'…'4'
02	1	Type EPC or TID (ASCII)	'E': EPC 'T': TID
03	1	Max. number of data carriers (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
05	1	Max. number of data carriers (ASCII) low byte	'0'…'9'
06	1	Data carrier select (ASCII)	'0': All '1': Selected
07	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Head number (ASCII)	'1'…'4'
02	1	Type EPC or TID (ASCII)	'E': EPC 'T': TID
03	1	Max. number of data carriers (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
05	1	Max. number of data carriers (ASCII) low byte	'0'…'9'
06	1	Number of bytes per data carrier (ASCII) high byte	'0'…'9'
07	1	Number of bytes per data carrier (ASCII) low byte	'0'…'9'
08	1	BCC	00_{hex}…FF_{hex}

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

9 Protocol

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <EOT>
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of bytes (ASCII) high b yte	'0'…'9'
03	1	Number of bytes (ASCII) middle byte	'0'…'9'
04	1	Number of bytes (ASCII) low byte	'0'…'9'
05	1	Packet number (ASCII) high byte	'0'…'9'
06		Packet number (ASCII) middle byte	'0'…'9'
07	1	Packet number (ASCII) low byte	'0'…'9'
08	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
13	1	Number of bytes (ASCII) low byte	'0'…'9'
14	1	Data	$00_{hex}…FF_{hex}$
…	…	…	$00_{hex}…FF_{hex}$
…	…	…	$00_{hex}…FF_{hex}$
Last byte	1	BCC	$00_{hex}…FF_{hex}$

The EPC and TID are sent with a length of 66 bytes, the data block is structured as follows:

Byte	Length	Command element	Value range
0	1	Antenna Port 1st data carrier	01_{hex}
1	1	Reserved	00_{hex}
2	1	EPC/TID 1st byte Tag 1	$00_{hex}…FF_{hex}$
3	1	EPC/TID 2nd byte Tag 1	$00_{hex}…FF_{hex}$
…	…	…	$00_{hex}…FF_{hex}$
65	1	EPC/TID 64th byte Tag 1	$00_{hex}…FF_{hex}$
66	1	EPC/TID 1st byte Tag 2	$00_{hex}…FF_{hex}$
67	1	EPC/TID 2nd byte Tag 2	$00_{hex}…FF_{hex}$
…	…	…	$00_{hex}…FF_{hex}$
Last byte	1	BCC	$00_{hex}…FF_{hex}$

EPC and TID format (64 bytes):

Byte	Length	Command element	Value range
0	1	Length EPC/TID	$00_{hex}…3E_{hex}$
1	1	Reserved	00_{hex}
2	1	EPC/TID Data[1]	$00_{hex}…FF_{hex}$
3	1	EPC/TID Data[2]	$00_{hex}…FF_{hex}$
…	…	…	$00_{hex}…FF_{hex}$
63	1	EPC/TID Data[62]	$00_{hex}…FF_{hex}$

9 Protocol

Example of a received data frame with 2 EPCs and 66 bytes per EPC

Byte	Data	Description
00	01_{hex}	Antenna Port EPC 1
01	00_{hex}	Reserved
02	$0C_{hex}$	Length EPC 1
03	00_{hex}	Reserved
04…53	00_{hex}, 00_{hex}	Leading zeros EPC1
54…65	12_{hex}, 11_{hex}, 10_{hex}, 09_{hex}, 08_{hex}, 07_{hex}, 06_{hex}, 05_{hex}, 04_{hex}, 03_{hex}, 02_{hex}, 01_{hex}	EPC 1: 01 02 03 04 05 06 07 08 09 10 11 12
66	01_{hex}	Antenna Port EPC 2
67	00_{hex}	Reserved
68	$0C_{hex}$	Length EPC 2
69	00_{hex}	Reserved
70…119	00_{hex}, 00_{hex}	Leading zeros EPC2
120…131	$0B_{hex}$, $0A_{hex}$, 09_{hex}, 08_{hex}, 02_{hex}, 02_{hex}, 03_{hex}, 04_{hex}, 05_{hex}, 06_{hex}, 02_{hex}, 01_{hex}	EPC 2: 01 02 06 05 04 03 02 02 08 09 0A 0B

9 Protocol

Command ID 'I': Read data carrier, bulk

► The *Bulk Read* command reads the data from a data carrier population. Optionally from all of the data carriers that are found in the active read/write zone of the antenna or from a subset that was previously selected with the *Select* command.

The *Bulk Read* command first reports only the number of data carriers that were detected in the active field of the antenna. The data in the data carriers is then read out and transmitted to the controller.

If the data carriers are removed from the active field of the antenna in between the detection and read out stages or if they cannot be successfully read out for other reasons, erroneous data may occur. In which case, the data will be marked as invalid via a check byte at the end of the data block and transmitted to the controller.
Data blocks marked as valid in their check bytes can be used without restrictions.
A maximum of 255 bytes from 255 data carriers can be read at a time.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'I'
01	1	Head number (ASCII)	'1'…'4'
02	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
07	1	Start address (ASCII) low byte	'0'…'9'
08	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
13	1	Number of bytes (ASCII) low byte	'0'…'9'
14	1	Data carrier selection	All (0) / Selected (1)
15	1	Maximum number of data carriers (ASCII) high byte	'0'…'9'
16	1	Maximum number of data carriers (ASCII) middle byte	'0'…'9'
17	1	Maximum number of data carriers (ASCII) low byte	'0'…'9'
18	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of data carriers (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
04	1	Number of data carriers (ASCII) low byte	'0'…'9'
05	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
10	1	Number of bytes (ASCII) low byte	'0'…'9'
11	1	BCC	00_{hex}…FF_{hex}

9 Protocol

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

If successfully executed the data are sent:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <EOT>
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of bytes high byte (ASCII)	'0'…'9'
…	…	…	'0'…'9'
04	1	Number of bytes low byte (ASCII)	'0'…'9'
05	1	Packet number (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
07	1	Packet number (ASCII) low byte	'0'…'9'
08	1	Data length (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
11	1	Data length (ASCII) low byte	'0'…'9'
12	1	Data	$00_{hex}…FF_{hex}$
…	…	…	$00_{hex}…FF_{hex}$
Last byte	1	BCC	$00_{hex}…FF_{hex}$

9 Protocol

The data have the following format:

Length	Meaning	Function description
1	Data Tag 1 [0]	Transmission of the 1st byte that was read from the 1st data carrier.
1	Data Tag 1 [1]	Transmission of the 2nd byte that was read from the 1st data carrier.
1	Data 1 […]	Additional data from the 1st data carrier
1	Check Byte 1	A check byte is transmitted in the last byte from the first data carrier, which indicates whether the data read is valid: 00_{hex}: Data valid FF_{hex}: Data invalid
1	Data Tag 2 [0]	Transmission of the 1st byte that was read from the 2nd data carrier.
1	Data Tag 2 [1]	Transmission of the 2nd byte that was read from the 2nd data carrier.
…	Data 2 […]	Additional data from the 2nd data carrier
1	Check byte Tag 2	A check byte is transmitted in the last byte from the second data carrier, which indicates whether the data read is valid: 00_{hex}: Data valid FF_{hex}: Data invalid
1	Data Tag n [0]	Transmission of the 1st byte that was read from the n-th data carrier.
1	Data Tag n [1]	Transmission of the 2nd byte that was read from the n-th data carrier.
…	Data Tag n […]	Additional data from the n-th data carrier
1	Check byte Tag n	A check byte is transmitted in the last byte from the n-th data carrier, which indicates whether the data read is valid: 00_{hex}: Data valid FF_{hex}: Data invalid

Command ID 'O': Read data carrier, EPC

► Reads the EPC memory area of a data carrier that was previously selected with the Select command.

In Single-Tag mode, that is, if it can be assured that only one data carrier is located in front of the active read/write zone antenna, then the *Select* command can be disregarded. The *Read from EPC* command will be automatically executed on the data carrier that is located in front of the antenna.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'O'
01	1	Head number (ASCII)	'1'…'4'
Last byte	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows and the command is carried out:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the EPC data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of bytes (ASCII) high byte	'0'…'9'
03	1	Number of bytes (ASCII) low byte	'0'…'9'
04	1	EPC data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Command ID 'y': Read data carrier, TID

► Reads the TID memory area of a data carrier that was previously selected with the *Select* command.

In Single-Tag mode, that is, if it can be assured that only one data carrier is located in front of the active read/write zone antenna, then the *Select* command can be disregarded. The *Read from EPC* command will be automatically executed on the data carrier that is located in front of the antenna.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'y'
01	1	Head number (ASCII)	'1'…'4'
Last byte	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the TID data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of bytes (ASCII) high byte	'0'…'9'
03	1	Number of bytes (ASCII) low byte	'0'…'9'
04	1	TID data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Command ID 'w': Write to data carrier, bulk

► The Bulk Write command writes data to a data carrier population. Optionally to all of the data carriers that are found in the active read/write zone of the antenna or from a subset that was previously selected with the *Select* command.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'w'
01	1	Head number (ASCII)	'1'…'4'
02	1	Start address (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
07	1	Start address (ASCII) low byte	'0'…'9'
08	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
13	1	Number of bytes (ASCII) low byte	'0'…'9'
14	1	Data carrier selection	'0': All '1': Selected
15	1	Maximum number of data carriers (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
07	1	Maximum number of data carriers (ASCII) low byte	'0'…'9'
07	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows with the first data block.

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Number of bytes (ASCII) low byte	'0'…'9'
07	1	Data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

9 Protocol

After a successful acknowledgment the data blocks are sent until the required number of blocks has been reached.

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
06	1	Number of bytes (ASCII) low byte	'0'…'9'
07	1	Data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

If execution is successful, the number of written data carriers is sent in the following format:

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of data carriers (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
04	1	Number of data carriers (ASCII) low byte	'0'…'9'
05	1	Number of written data carriers (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
07	1	Number of written data carriers (ASCII) low byte	'0'…'9'
08	1	Status	'P': Pending 'F': Finished
Last byte	1	BCC	00_{hex}…FF_{hex}

9 Protocol

Command ID 'v': Write to data carrier, EPC

► Writes to the EPC memory area of a data carrier that was previously selected with the *Select* command.

In Single-Tag mode, that is, if it can be assured that only one data carrier is located in front of the active read/write zone antenna, then the *Select* command can be disregarded. The *Write to EPC* command will be automatically executed on the data carrier that is located in front of the antenna.

Note
The EPC can have a length of 2...62 bytes; the number of bytes must be even.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'v'
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of bytes (ASCII) high byte	'0'…'9'
03	1	Number of bytes (ASCII) low byte	'0'…'9'
04	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>
01	1	EPC data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

9 Protocol

Command ID 'k': Kill

► The *Kill* command can deactivate a data carrier previously selected with the *Select* command.

Note
Executing the *Kill* command permanently deactivates the selected data carrier.
The deactivation cannot be undone.

Note
In order to execute the Kill command, a *Kill* password must first be set and written to the data carrier.
Information about password protection and about locking and unlocking ("Lock") of UHF RFID data carriers can be found in the UHF RFID standards EPCglobal™ Radio Frequency Identity Protocols Class-1 Generation-2 UHF RFID and ISO IEC 18000-63.
The EPCglobal™ standard is available online at www.gs1.org/standards.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'k'
01	1	Head number (ASCII)	'1'…'4'
02	1	Password 1 (ASCII) high byte	'0'…'F'
03	1	Password 1 (ASCII) low byte	'0'…'F'
04	1	Password 2 (ASCII) high byte	'0'…'F'
05	1	Password 2 (ASCII) low byte	'0'…'F'
06	1	Password 3 (ASCII) high byte	'0'…'F'
07	1	Password 3 (ASCII) low byte	'0'…'F'
08	1	Password 4 (ASCII) high byte	'0'…'F'
09	1	Password 4 (ASCII) low byte	'0'…'F'
10	1	BCC	$00_{hex}…FF_{hex}$

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

Command ID 'l': Lock

For BIS VU heads:

► The *Lock* command can block read or write access, as well as access of any kind, to memory areas (RES, EPC, TID, USER) of a UHF data carrier. Depending on the level of security, the memory areas can be password protected or completely blocked.

The *Mask* and *Action* fields specify which memory areas receive a new Lock Status and how these should appear. Using Bit Masks allows the *Lock* Status of multiple memory areas to be changed at the same time.

Note
In order to successfully execute the command *Lock* it is necessary to first provide the correct *Access* password for the data carrier using a Write Parameter command. Passwords (*Access* and *Kill*) are stored in the Reserved memory area.

Mask — Bit Mask (16-bit), used to determine which memory area of the selected data carrier should be processed with respect to its Lock Status.
0: Memory area is not affected by the *Action* field
1: Memory area is affected by the *Action* field

Action — Bit Mask (16-Bit), used to determine how the Lock Status of the respective memory areas should be changed.
The Lock Status can be set for individual memory areas by setting or resetting the *Lock* and *Permalock* bits.

Bit-No.	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Memory area	Access PW	Access PW	EPC	EPC	TID	TID	USER	USER
Mask[0]	Mask	Mask	Mask	Mask	Mask	Mask	Mask	Mask
Action[0]	Lock	Perma-lock	Lock	Perma-lock	Lock	Perma-lock	Lock	Perma-lock

Bit-No.	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**
Memory area	Not used						Kill PW	Kill PW
Mask[1]	Not used						Mask	Mask
Action[1]	Not used						Lock	Perma-lock

Lock Status of the EPC, TID and USER memory areas:

Lock	**Permalock**	**Lock Status**	
0	0	Read and Write:	No Password
0	1	Read and write: (Status can not always be changed)	No Password
1	0	Read: Write:	No Password Access Password
1	1	Read: Write: (status can not always be changed)	No Password Access Password

9 Protocol

> **Note**
> The TID memory area is inherently read-only regardless of the *Lock* Status and can only be read.

Lock status of the memory ranges *Reserved* (*Access-Password* and *Kill*-password):

Lock	Permalock	Lock Status	
0	0	Read and Write:	No Password
0	1	Read and write: (Status can not always be changed)	No Password
1	0	Read and Write:	Access Password
1	1	Read and write: (Status can not always be changed)	Not Possible

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'l'
01	1	(ASCII)	'1'…'4'
02	1	Mask (ASCII) high byte	'0'…'F'
03	1	Mask (ASCII) low byte	'0'…'F'
04	1	Action (ASCII) high byte	'0'…'F'
05	1	Action (ASCII) low byte	'0'…'F'
06	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

For BIS C heads:

► The Lock command can be used to lock memory sectors of a BIS tag. The memory can be locked in sectors of 4, 8 and 16 bytes at the beginning of the working memory.

The command parameters *Mask* and *Action* specify the range to be locked.

Note
The Lock command is supported by type BIS C-1_ _-04, BIS C-1_ _-05 and BIS C-1_ _-11 tags.

Mask — This 16-bit mask is used to specify the memory sector to be processed depending on its lock status.
- 0000_{hex}: Memory not locked
- 0001_{hex}: Memory address from 0…3 is locked
- 0002_{hex}: Memory address from 0…7 is locked
- 0003_{hex}: Memory address from 0…15 is locked

Action — This 16-bit mask is used to specify the status to which the selected memory range should be changed.
- 0000_{hex}: Memory range not locked
- 0001_{hex}: Memory range locked

Lock status of the memory:

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'l'
01	1	Head number (ASCII)	'1'…'4'
02	1	Mask (ASCII), Bit Nr. 15…12, high byte	'0'…'F'
03	1	Mask (ASCII), Bit Nr. 11…8	'0'…'F'
04	1	Mask (ASCII), Bit Nr. 7…4	'0'…'F'
05	1	Mask (ASCII), Bit Nr. 3…0, low byte	'0'…'F'
06	1	Action (ASCII), Bit Nr. 15…12, high byte	'0'…'F'
07	1	Action (ASCII), Bit Nr. 11…8	'0'…'F'
08	1	Action (ASCII), Bit Nr. 7…4	'0'…'F'
09	1	Action (ASCII), Bit Nr. 3…0, low byte	'0'…'F'
10	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

9 Protocol

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

Example 1:
Lock memory area 3 of head 1 sperren:

Mask "03" – Memory area address 0…15 is locked
Action "01" – Memory area is locked

Application → BIS V
Command: 'l' '1' '0' '0' '0' '3' '0' '0' '0' '1' '_'

Application ← BIS V
<ACK> '0'

Application → BIS V
<STX>

Application ← BIS V
<ACK> '0'

Example 2:
Unlock memory area of head 1:

Mask "00" – Memory area is unlocked.
Action "00" – Memory area is unlocked.

Application → BIS V
Command: 'l' '1' '0' '0' '0' '0' '0' '0' '0' '0' ']'

Application ← BIS V
<ACK> '0'

Application → BIS V
<STX>

Application ← BIS V
<ACK> '0'

9 Protocol

Command ID 'G': Read parameters

► Reads out the parameter values that are currently set in the read/write head.

Note
The description of the individual parameters and their interpretation can be found in the manual for the BIS VU read/write head.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'G'
01	1	Head number (ASCII)	'1'…'4'
02	1	Parameter (ASCII Hex) high byte	'0'…'F'
…	…	…	'0'…'F'
05	1	Parameter (ASCII Hex) low byte	'0'…'F'
06	1	BCC	00_{hex}…FF_{hex}

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Reserved	'0'
02	1	Head number (ASCII)	'1'…'4'
03	1	Number of bytes (ASCII) high byte	'0'…'9'
04	1	Number of bytes (ASCII) low byte	'0'…'9'
05	1	Parameter (ASCII Hex) high byte	'0'…'F'
…	…	…	'0'…'F'
08		Parameter (ASCII Hex) low byte	'0'…'F'
09	1	Parameter data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

9 Protocol

Command ID 'E': Write parameters

► The *Write Parameters* command transfers parameters to the BIS VU read/write head that affect its behavior.

Note
The description of the individual parameters and their interpretation can be found in the manual for the BIS VU read/write head.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'E'
01	1	Head number (ASCII)	'1'…'4'
02	1	Number of bytes (ASCII) high byte	'0'…'9'
03	1	Number of bytes (ASCII) low byte	'0'…'9'
04	1	Parameter (ASCII Hex) high byte	'0'…'F'
…	…	…	'0'…'F'
07	1	Parameter (ASCII Hex) low byte	'0'…'F'
08	1	Data	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table
02	1	BCC	00_{hex}…FF_{hex}

Command ID 'r': Read RSSI

► This command returns the RSSI (Receive Signal Strength Indicator) which is determined for the selected R/W head.

Real-Time RSSI	Returns the actual, current RSSI value
Pilot Tone RSSI	Returns the RSSI value of the pilot tone
Data RSSI	Returns the RSSI value of the requested tag data. First a data carrier must be selected using the *Select* command.

> **Tip**
> The RSSI is a value which is proportional to the signal strength of the received response signal from the data carrier.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'r'
01	1	Head number (ASCII)	'1'…'4'
02	1	RSSI Type (ASCII)	'0': Real-Time RSSI '1': Pilot Tone RSSI '2': Data RSSI
03	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Head number (ASCII)	'1'…'4'
02	1	I-value (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
04	1	I-value (ASCII) low byte	'0'…'9'
05	1	Q-value (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
07	1	Q-value (ASCII) low byte	'0'…'9'
08	1	BCC	00_{hex}…FF_{hex}

Command ID 'z': Select (Select Data Carrier in Multi-tag Mode)

► In the Multi-tag Mode, the *Select* command selects a single data carrier from within a data carrier population. A data carrier that is located in the active read/write zone of the antenna is accessed and selected directly based on its EPC or its TID and is then available for further processing.

For the BIS V only ECP or TID can be selected, selecting USER data is not possible. The EPC and TID are output in reverse order with leading zeros.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'z'
01	1	Head number (ASCII)	'1'…'4'
02	1	Type EPC/TID and USER data (ASCII)	'E': EPC 'T': TID 'U': USER
03	1	1st byte of data carrier detection	00_{hex}…FF_{hex}
…	…	…	00_{hex}…FF_{hex}
66	1	Last byte of data carrier detection	00_{hex}…FF_{hex}
67	1	Start address (ASCII) hight byte	'0'…'9'
…	…	…	'0'…'9'
72	1	Start address (ASCII) low byte	'0'…'9'
73	1	Number of bytes (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
78	1	Number of bytes (ASCII) low byte	'0'…'9'
79	1	USER-data	00_{hex}…FF_{hex}
…	1	USER-data	00_{hex}…FF_{hex}
…	1	USER-data	00_{hex}…FF_{hex}
Last byte	1	BCC	00_{hex}…FF_{hex}

Data carrier data (EPC/TID)

Byte	Length	Command element	Value range
00	1	Length ECP/TID	00_{hex}…$3E_{hex}$
01	1	Reserved	00_{hex}
02	1	EPC Data[1]	00_{hex}…FF_{hex}
03	1	EPC Data[2]	00_{hex}…FF_{hex}
04	1	EPC Data[3]	00_{hex}…FF_{hex}
…	…	EPC Data[…]	00_{hex}…FF_{hex}
63	1	EPC Data[62]	00_{hex}…FF_{hex}

Example for entering data carrier data (EPC/TID):
EPC: 01_{hex} 02_{hex} 03_{hex} 04_{hex} 05_{hex} 06_{hex} 07_{hex} 08_{hex} 09_{hex} 10_{hex} 11_{hex} 12_{hex}

Byte	Data	Description
00	0C	Length EPC 1
01	00	Reserved
02…51	00_{hex}, 00_{hex}	Leading zeros EPC 1
52…63	12_{hex}, 11_{hex}, 10_{hex}, 09_{hex}, 08_{hex}, 07_{hex}, 06_{hex}, 05_{hex}, 04_{hex}, 03_{hex}, 02_{hex}, 01_{hex}	EPC 1: *01 02 03 04 05 06 07 08 09 10 11 12*

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

Command ID 'o': Read beam power

► Reads out the current beam power (ERP). The beam power is returned as a value in the form of ¼ dBm.

Example:
Reading out the beam power returns the value of 54_{hex} (= 84).
This corresponds to a beam power of 21 dBm: 84/4 = 21

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'o'
01	1	Head number (ASCII)	'1'…'4'
04	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK>
01	1	Beam power (ASCII hex) high byte	'0'…'f'
02	1	Beam power (ASCII Hex) low byte	'0'…'f'
03	1	BCC	00_{hex}…FF_{hex}

9 Protocol

Command ID 'p': Write beam power

► The beam power for the antenna (ERP or EIRP), which is specified as a value in ¼ dBm increments, affects the maximum range of the read/write range of the antenna.
The maximum beam power depends on the read/write head used.

Example:
Configuring a beam power of 21 dBm (125 mW): 21 × 4 = 84 (= 54_{hex})

Note
The set power is not persistently stored and is reset to the stored standard value when starting up the reader.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'p'
01	1	Head number (ASCII)	'1'…'4'
02	1	Beam power (ASCII hex) high byte	'0'…'F'
03	1	Beam power (ASCII Hex) low byte	'0'…'F'
04	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

Command ID 'n': Unselect (unselecting a data carrier selection)

► The *Unselect* command undoes one data carrier selection that was carried out with the *Select* command. If a selection is not active, the status will remain unchanged.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'n'
01	1	Head number (ASCII)	'1'...'4'
Last byte	1	BCC	00_{hex}...FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

9 Protocol

Command ID '$': Custom parameter

► This command is used to enable or disable the RFID parameter *Custom Parameter*.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'$'
01	1	Head number (ASCII)	'1'…'4'
02	1	Value (ASCII)	'0': disabled '1': enabled
03	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

9 Protocol

Command ID '%': Set keep-alive configuration

► Enabling the keep-alive function for the TCP connection. The timeout parameter specifies the time interval at which a keep-alive request is sent.

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'%'
01	1	Value (ASCII)	'0': disabled '1': enabled
03	1	Timeout (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
08	1	Timeout (ASCII) low byte	'0'…'9'
09	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

9 Protocol

Command ID '=': Read keep-alive configuration

Byte	Length	Command element	Value range
00	1	Command ID (ASCII)	'='
01	1	BCC	00_{hex}…FF_{hex}

Acknowledgment:

Byte	Length	Command element	Value range
00	1	Status	<ACK> or <NAK>
01	1	Status number	See Status Number table

The reply then follows:

Byte	Length	Command element	Value range
00	1	Control command	<STX>

After errorless reading the data are sent.

Byte	Length	Command element	Value range
00	1	Status	<ACK> oder <NAK>
01	1	Value (ASCII)	'0': disabled '1': enabled
02	1	Timeout (ASCII) high byte	'0'…'9'
…	…	…	'0'…'9'
07	1	Timeout (ASCII) low byte	'0'…'9'
08	1	BCC	00_{hex}…FF_{hex}

9 Protocol

Read/write times

> **Note**
> All specifications are typical values. Deviations are possible depending on the application and combination of R/W head and data carrier.
> The specifications apply to static operation; no CRC_16 data checking.
> All specified read/write times are based on the communication between the data carrier and the read/write head. The times for the data communication between the processor unit and the host control system are not included.

For read/write heads BIS VM

Mifare:

Read times Data carrier with 16 bytes per block	
Data carrier detection	~ 20 ms
Read bytes 0 to 15	~ 25 ms
For each additional 16-byte block started	~ 10 ms

Write times Data carrier with 16 bytes per block	
Data carrier detection	~ 20 ms
Write bytes 0 to 15	~ 60 ms
For each additional 16-byte block started	~ 30 ms

ISO 15693:

Read times Data carrier with 16 bytes per block	
Data carrier detection	~ 20 ms
Read bytes 0 to 15	~ 25 ms
For each additional 16-byte block started	~ 10 ms

Write times Data carrier with 16 bytes per block		
	FRAM (BIS M-1_ _-02/20)	EEPROM (BIS M-1_ _-03/07/08)
Data carrier detection	~ 20 ms	~ 20 ms
Write bytes 0 to 15	~ 60 ms	~ 80 ms
For each additional 16-byte block started	~ 25 ms	~ 80 ms

High speed*:

Read times Data carrier with 64 bytes per block	
Data carrier detection	~ 20 ms
Read bytes 0 to 63	~ 14 ms
For each additional 64-byte block started	~ 6 ms

Write times Data carrier with 64 bytes per block	
Data carrier detection	~ 20 ms
Write bytes 0 to 63	~ 30 ms
For each additional 64-byte block started	~ 15 ms

*These times apply only for the combination of BIS VM-3_ _-**4**01-S4 read/write head with BIS M-1_ _-**11**/A, BIS M-1_ _-**13**/A, BIS M-1_ _-**14**/A, or BIS M-1_ _-**15**/A data carriers.

9 Protocol

For read/write heads BIS VL

Read times:

Data carrier with 16 byte blocks	BIS L-1_ _
Data carrier detection	~ 110 ms
Read bytes 0 to 15	~ 175 ms
For each additional 16-byte block started	~ 40 ms

Data carrier BIS L-2_ _
Data carrier detection + Read data carrier ≤ 140 ms

Write times:

Data carrier with 16 byte blocks	BIS L-1_ _
Data carrier detection	~ 110 ms
Write bytes 0 to 15	~ 285 ms
For each additional 16-byte block started	~ 100 ms

Data carrier BIS L-2_ _
Writing not possible

For read/write heads BIS C

Read times in static mode

Data carrier with 32 byte blocks	
No. of bytes	**Read time [ms]**
0 to 31	110
For each additional 32-byte block started	120

Data carrier with 64 byte blocks	
No. of bytes	**Read time [ms]**
0 to 63	220
For each additional 64-byte block started	230

Write times in static mode

Data carrier with 32 byte blocks	
No. of bytes	**Read time [ms]**
0 to 31	110 + n * 10
≥ 32 bytes	y * 120 + n * 10

Data carrier with 64 byte blocks	
No. of bytes	**Read time [ms]**
0 to 63	220 + n * 10
≥ 64 bytes	y * 230 + n * 10

n = Number of contiguous bytes to write
y = Number of blocks to be processed

9 Protocol

For read/write heads BIS C

Example: 17 bytes should be written starting at address 187. Data carrier = 32 bytes per block. Blocks 5 and 6 are processed, since the start address 187 is in block 5 and end address 203 is in block 6.
t = 2 * 120 + 17 * 10 = 410

Read times within the first block in dynamic mode

Data carrier with 32 byte blocks	
No. of bytes	**Read time [ms]**
0 to 3	14
For each additional byte	3,5
0 to 31	112

Data carrier with 64 byte blocks	
No. of bytes	**Read time [ms]**
0 to 3	14
For each additional byte	3,5
0 to 63	224

m = Highest address to read
Formula: t = (m + 1) * 3.5 ms

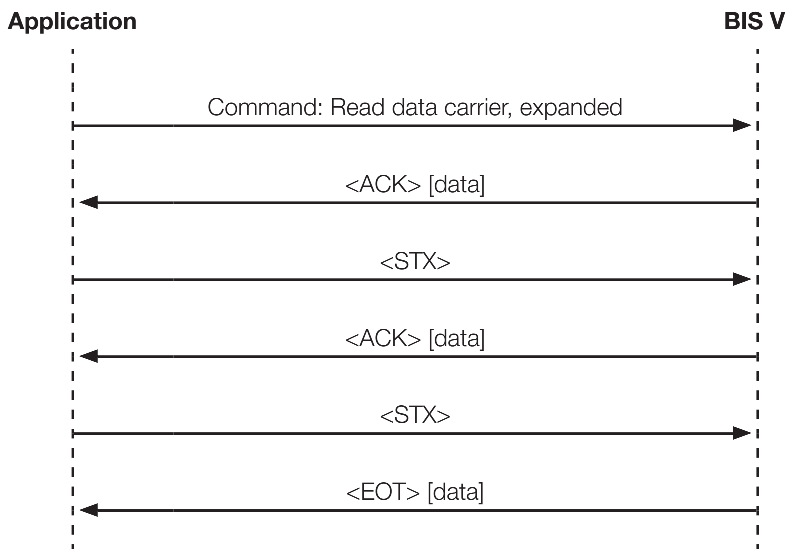
Example: Read 11 bytes starting at address 9. This means that the largest address to be read is 19. This yields 70 ms.

Dynamic operation with BIS C: The times indicated apply after the data carrier has been detected. Otherwise 45 ms must be added for powering up until the data carrier is recognized. To achieve the read times specified in dynamic operation, the Tag Type parameter has to be set to "BIS C 32 Byte" or "BIS C 64 Byte" on the respective head.

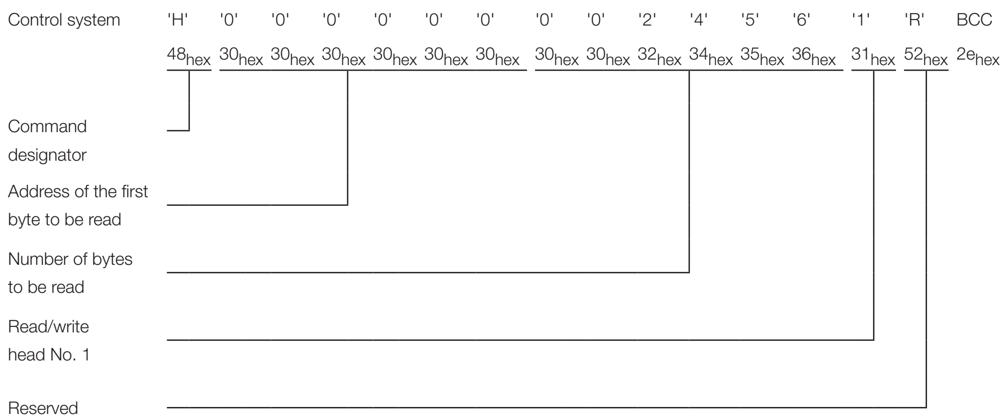
9 Protocol

Example 1: Read data carrier, expanded

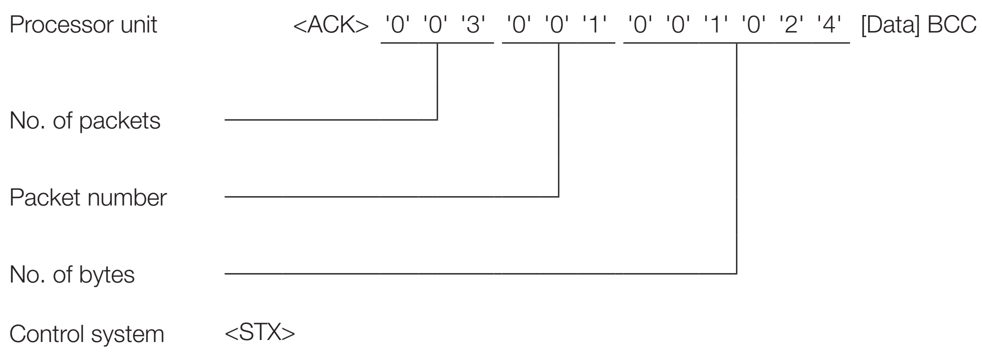
Read data carrier at read/write head 1, 2456 bytes USER data starting at Start address 0.

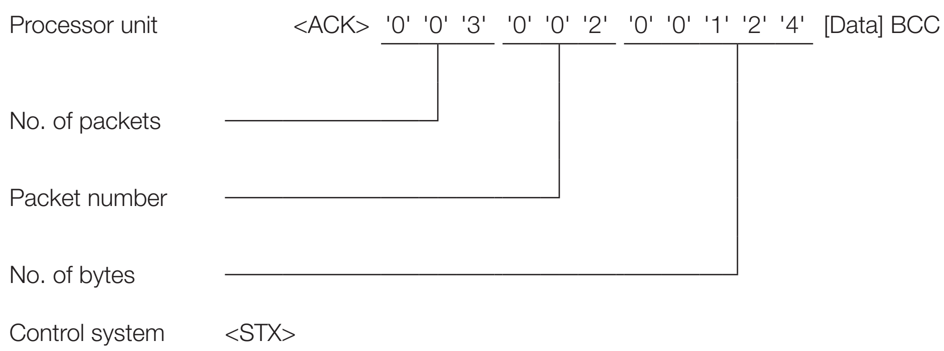


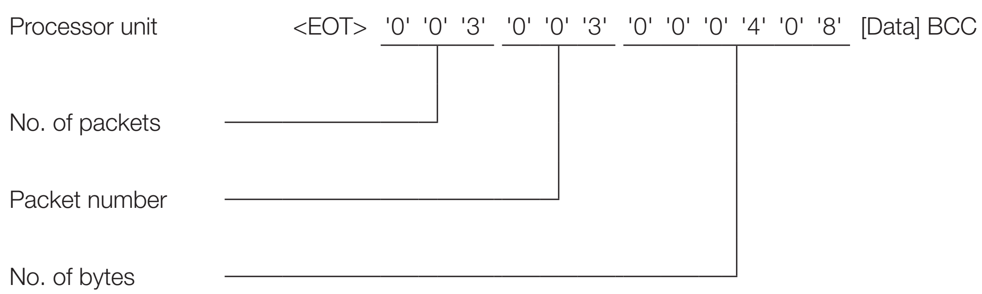
Telegram example:



9 Protocol

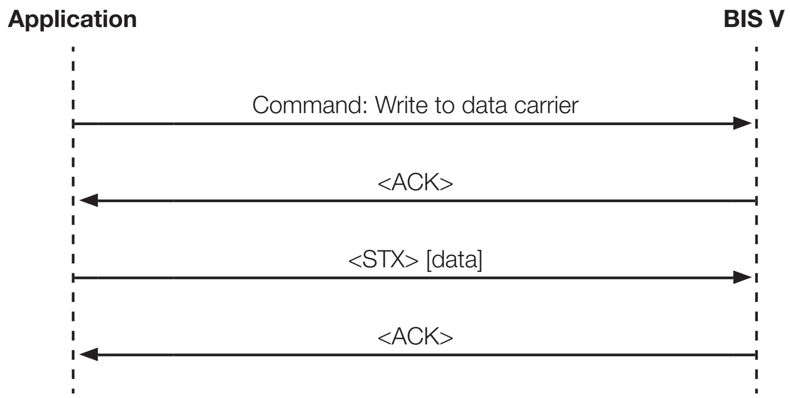

Processor unit
<ACK> '0' '0' '3' '0' '0' '1' '0' '0' '1' '0' '2' '4' [Data] BCC
No. of packets
Packet number
No. of bytes
Control system
<STX>


Processor unit
<ACK> '0' '0' '3' '0' '0' '2' '0' '0' '1' '2' '4' [Data] BCC
No. of packets
Packet number
No. of bytes
Control system
<STX>

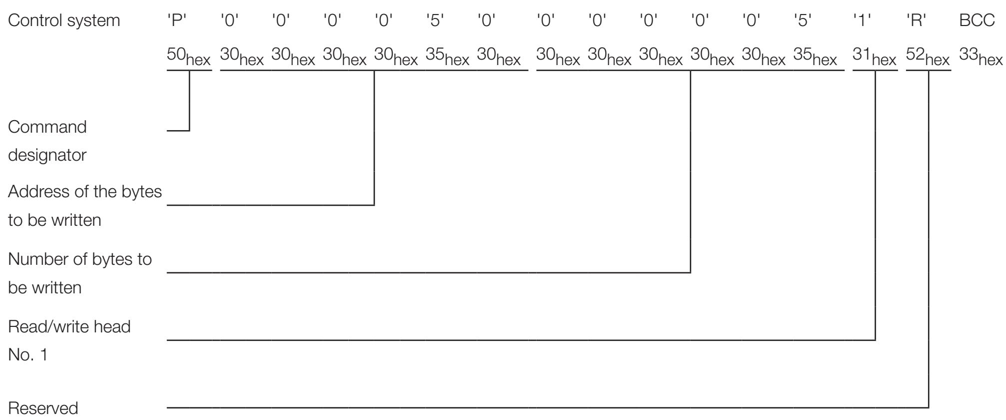

Processor unit
<EOT> '0' '0' '3' '0' '0' '3' '0' '0' '0' '4' '0' '8' [Data] BCC
No. of packets
Packet number
No. of bytes

Example 2: Write to data carrier

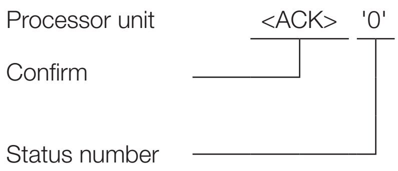
Write USER data to data carrier a read/write head 1,
5 bytes starting at Start address 50.
USER data: 01_{hex} 02_{hex} 03_{hex} 04_{hex} 05_{hex}

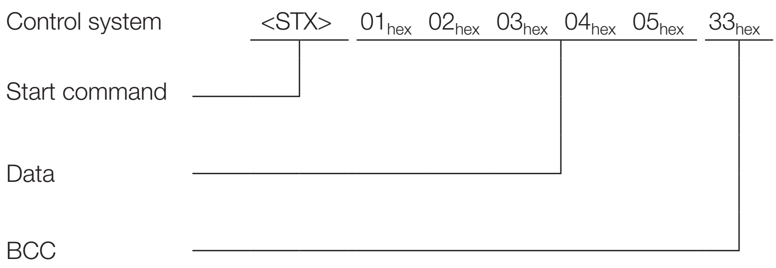


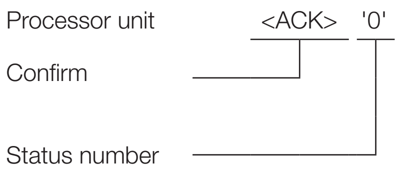
Telegram example:



9 Protocol


Processor unit
<ACK> '0'
Confirm
Status number

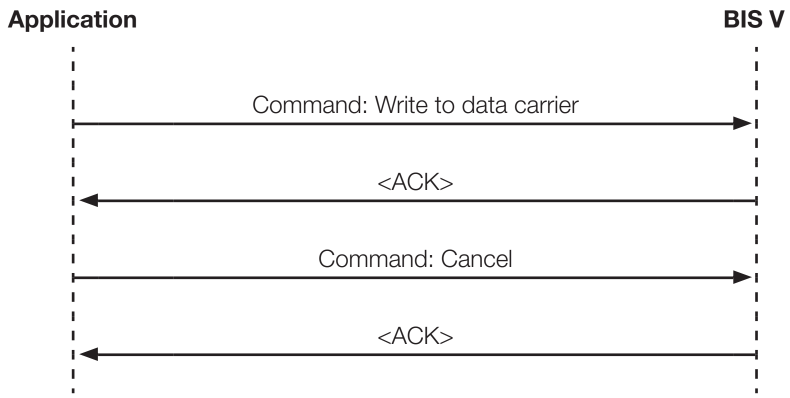

Control system
<STX> 01_{hex} 02_{hex} 03_{hex} 04_{hex} 05_{hex} 33_{hex}
Start command
Data
BCC


Processor unit
<ACK> '0'
Confirm
Status number

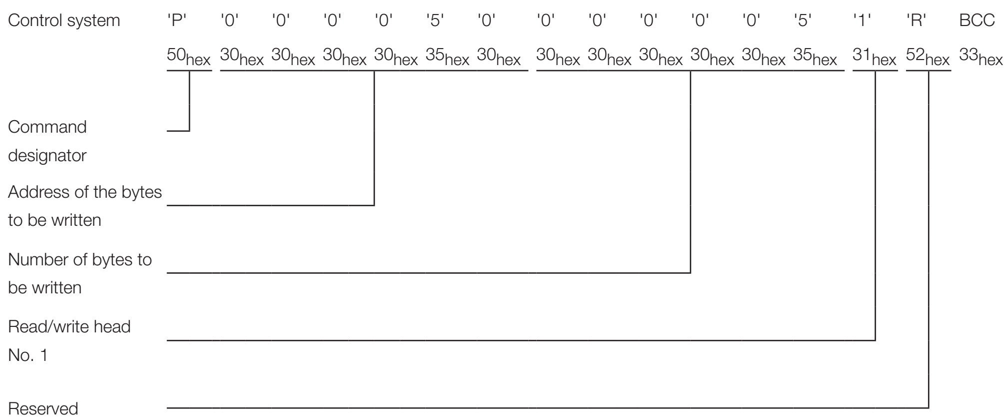
9 Protocol

Example 3: Write to data carrier with cancel

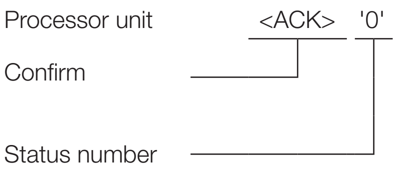
Write USER data to the data carrier at read/write head 1, 5 bytes starting at Start address 50.
Cancel after first acknowledgment.
USER data: 01_{hex} 02_{hex} 03_{hex} 04_{hex} 05_{hex}

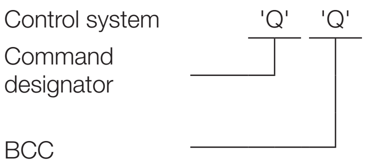


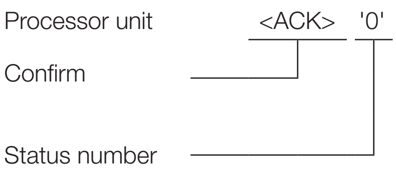
Telegram example:



9 Protocol


Processor unit
<ACK>
'0'
Confirm
Status number

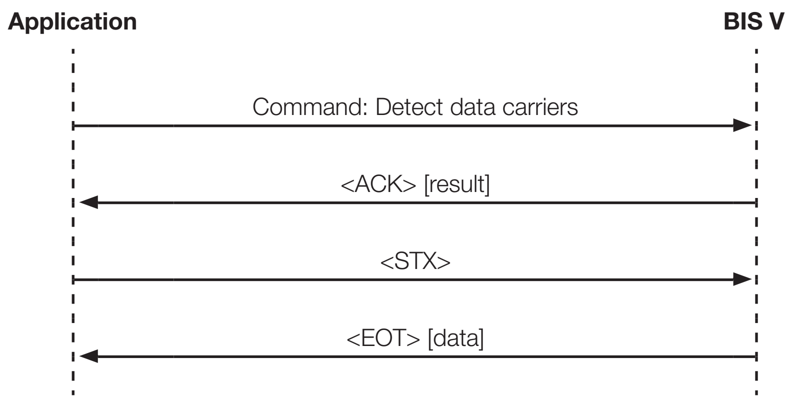

Control system
'Q'
'Q'
Command designator
BCC


Processor unit
<ACK>
'0'
Confirm
Status number

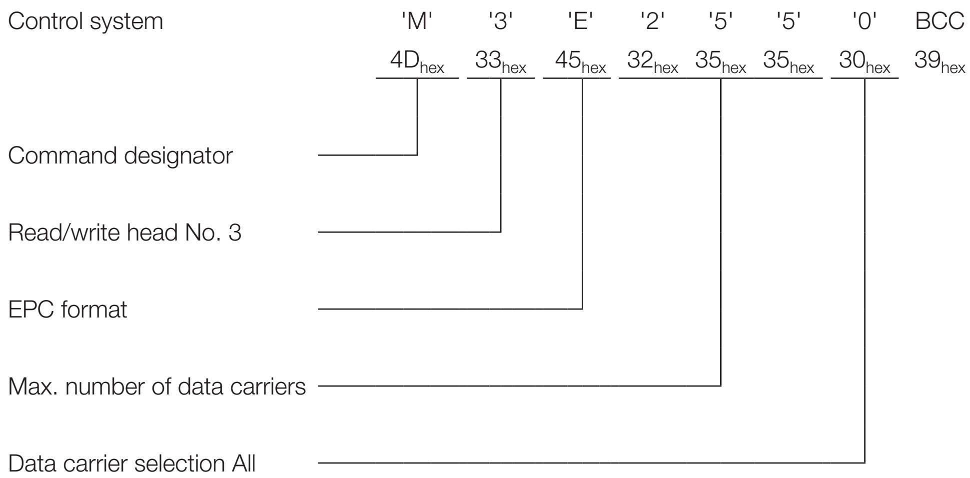
9 Protocol

Example 4: Read data carrier (only BIS VU)

EPCs of the data carrier located at read/write head 3 are read.



Telegram example:



9 Protocol

Control system <ACK> '3' 'E' '0' '0' '1' '6' '4' BCC

Read/write head No. 3

EPC format

No. of data carriers

Number of bytes per EPC

Control system <STX>

Processor unit <EOT> '3' '0' '0' '1' '0' '0' '1' '0' '0' '0' '0' '6' '6' [Data] BCC

Read/write head No. 3

No. of packets

Packet number

No. of bytes

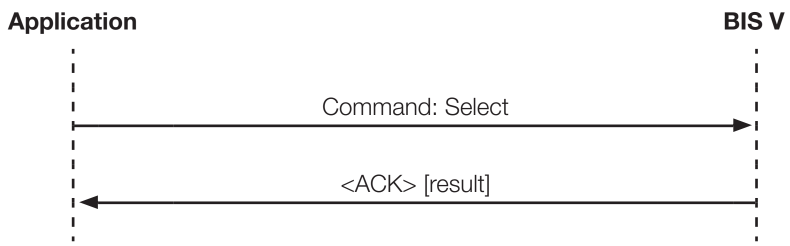
Data:

Byte	Data	Description
00	01_{hex}	Antenna number of the selected R/W head
01	00_{hex}	Reserved
02	$0C_{hex}$	EPC length
03	00_{hex}	Reserved
04…53	00_{hex}, 00_{hex}	Leading zeros EPC
54…65	12_{hex}, 11_{hex}, 10_{hex}, 09_{hex}, 08_{hex}, 07_{hex}, 06_{hex}, 05_{hex}, 04_{hex}, 03_{hex}, 02_{hex}, 01_{hex}	EPC: *01 02 03 04 05 06 07 08 09 10 11 12*

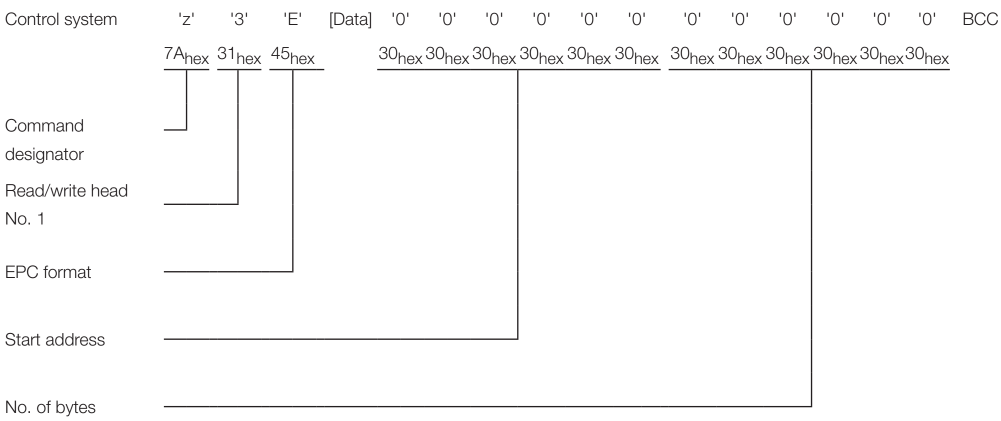
9 Protocol

Example 5: Select (only BIS VU)

Selecting a certain data carrier at read/write head 1.
EPC: 02_{hex} 03_{hex} 04_{hex} 05_{hex} 06_{hex} 07_{hex} 08_{hex} 09_{hex} 10_{hex} 11_{hex} 12_{hex}



Telegram example:



Data:

Byte	Data	Description
00	$0C_{hex}$	EPC length
01	00_{hex}	Reserved
02…51	00_{hex}, 00_{hex}	Leading zeros EPC
52…63	12_{hex}, 11_{hex}, 10_{hex}, 09_{hex}, 08_{hex}, 07_{hex}, 06_{hex}, 05_{hex}, 04_{hex}, 03_{hex}, 02_{hex}, 01_{hex}	EPC: *01 02 03 04 05 06 07 08 09 10 11 12*

10 Webserver

The BIS V-TCP/IP device includes an integrated webserver for retrieving detailed information on the current status. Additionally, this can be used for configuring the IP settings and for setting parameters for devices, head and IO-Link.

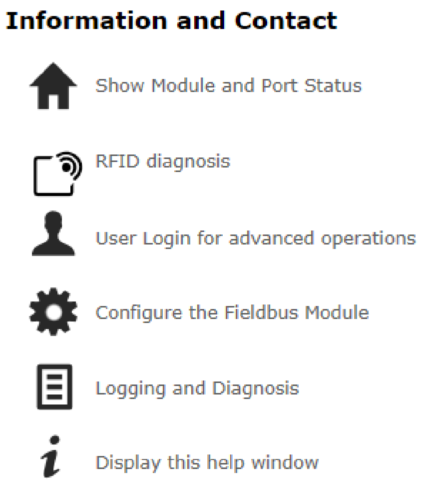
For opening a connection with the Web server:

► Enter IP address of the module in the address line of the browser.

Please use Internet Explorer 10 or higher.

10.1 Navigation

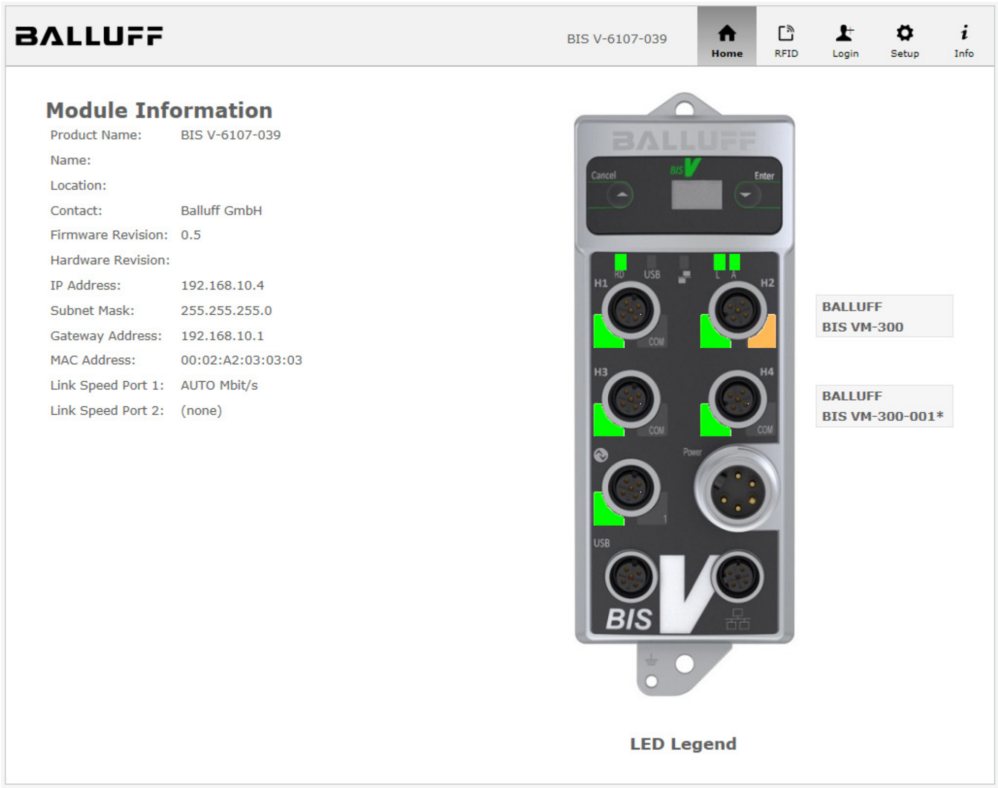
Clicking on the icons in the navigation bar in the upper section of the web server allows the various pages of the web server to be opened.



10 Webserver

10.2 Home

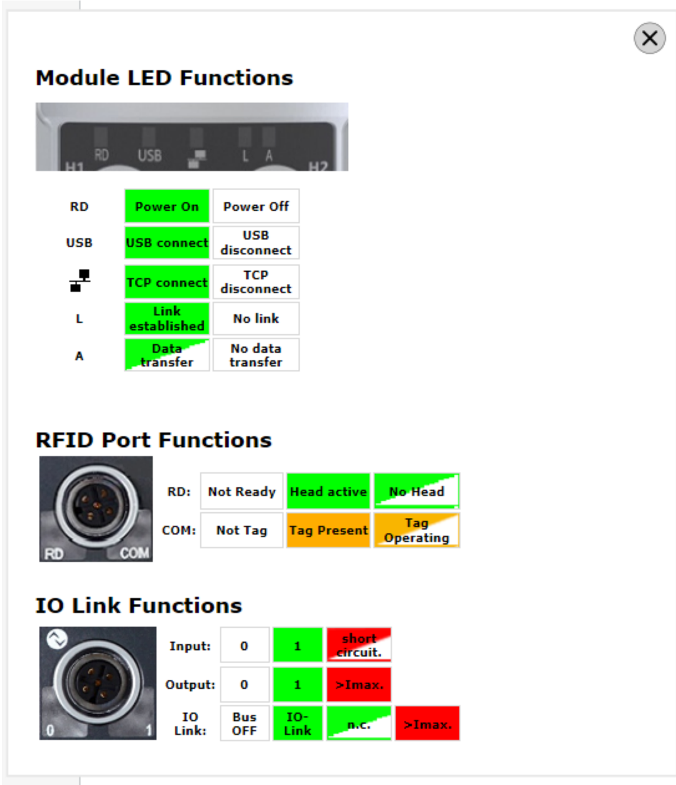
Here the information for the processor unit configuration is shown. The device image is dynamic. The animated LEDs correspond to the current device status.



If an RFID R/W head or an IO-Link-device is connected to the respective ports, then additional information on the connected module will be displayed alongside the status information. Clicking on this text or the device port acts as a link that takes you to "RFID".

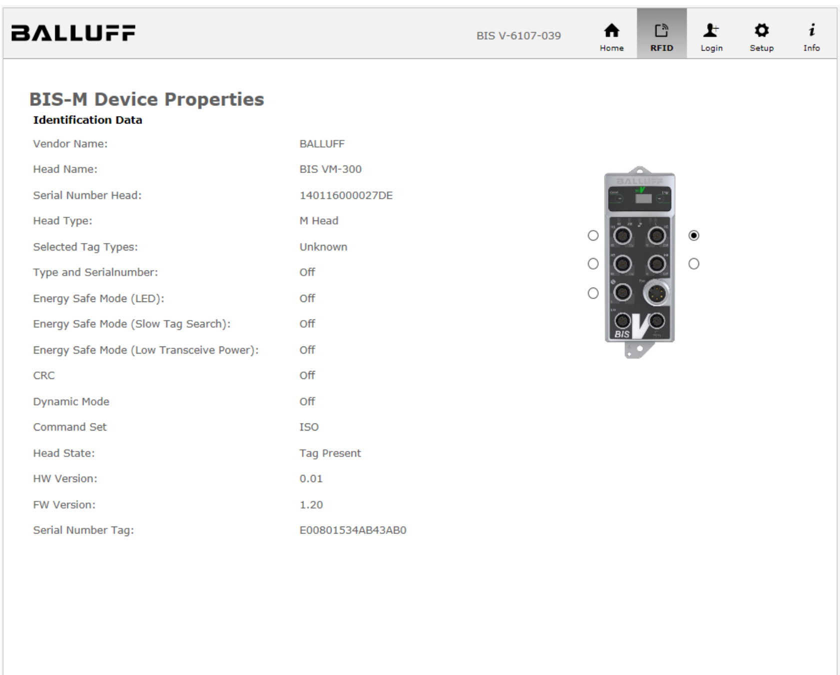
10 Webserver

The link "LED Legend" opens a window with a short explanation of the individual LEDs.



10.3 RFID

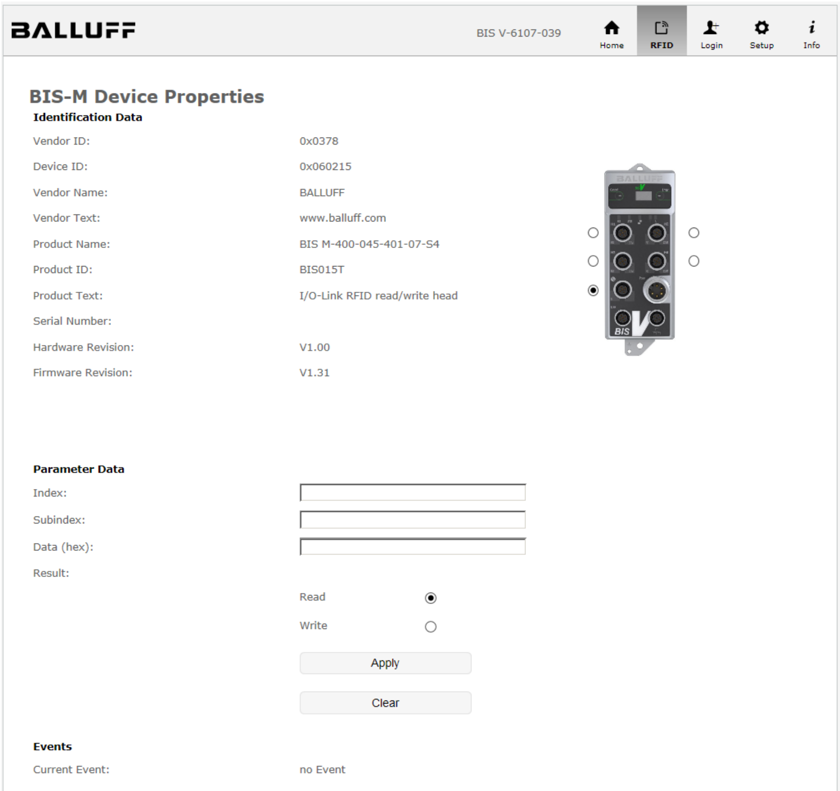
The parameter settings of the selected module (R/W heads) are shown on this page. Each module can be selected separately.
IO-Link modules can also be configured using this page.



10 Webserver

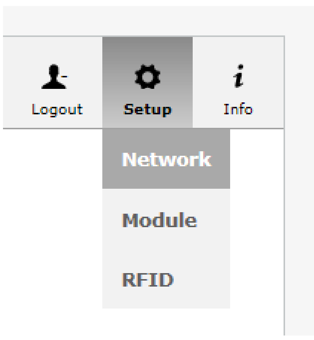
IO-Link I/O port

Here the IO-Link device connected to the IO-Link port is shown/entered.
The IO-Link device can be parameterized on this page.



10.4 Setup

The setup is divided into three parts: network, modules and RFID.



This function can only be used after a successful login.

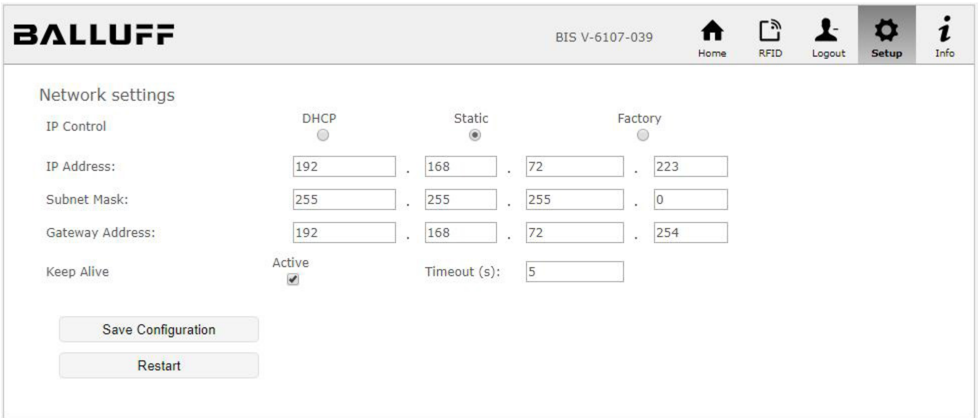
Password: BISVTCP

10 Webserver

Network

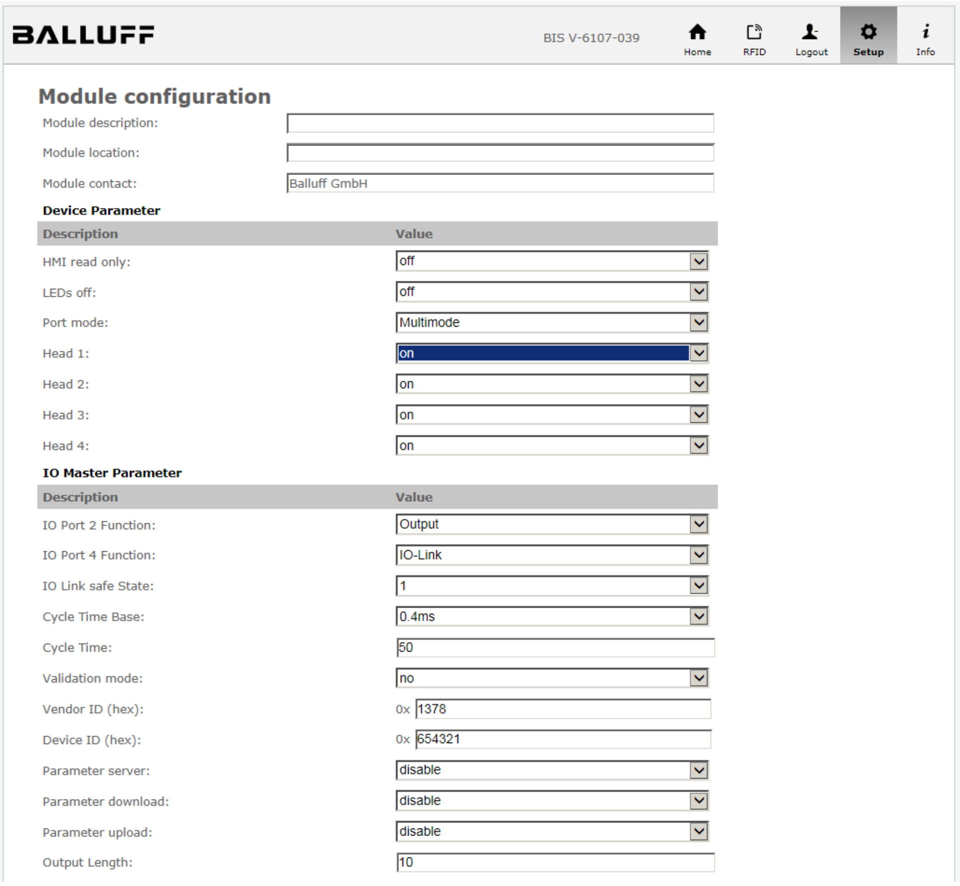
IP-Control can be used to specify whether the *IP address* is automatically assigned via *DHCP* or manually (*Static*). Factory resets the *IP address* to the factory default setting *192.168.72.223*. Clicking on the *Save Configuration* button saves the setting in the device.
This set configuration takes effect with the next restart.

► To restart the device, click on the *Restart* button.



Modules

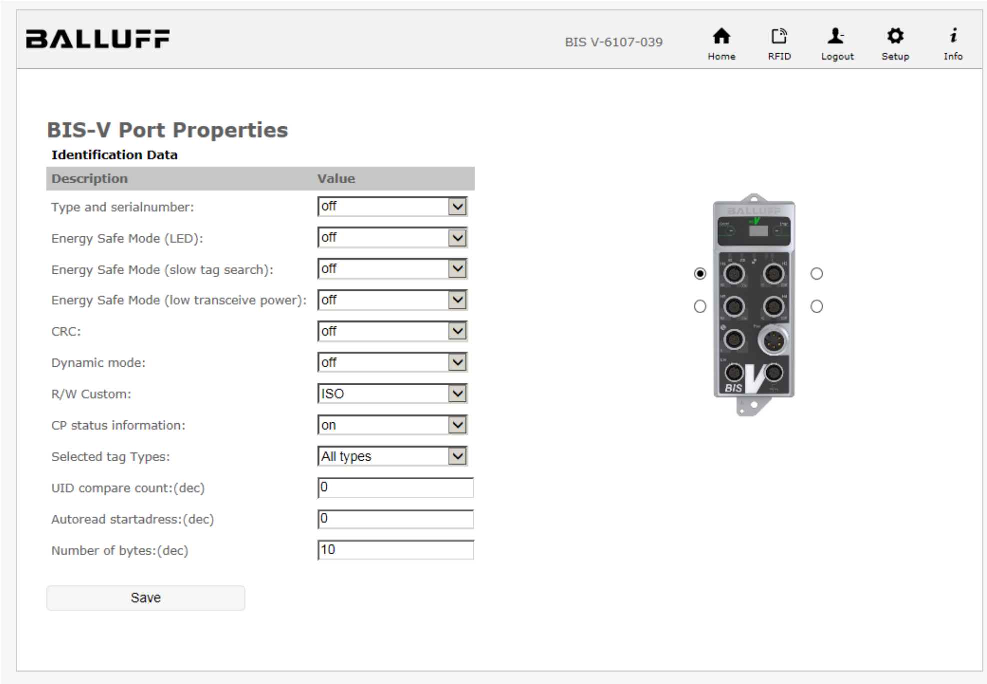
On this page you can edit the module description and module position. You can also set devices and IO-Link master parameters.



10 Webserver

RFID

On this page you can set the parameters for the selected head.



Logout

Exit the expanded functions "Setup/*":

► Click on the "Logout" button in the navigation line.

10 Webserver

Info Display of the contact data for Balluff and legend for the navigation elements in the menu line.

Appendix

Type code — **BIS V-6 1 07-039-C005**

Balluff Identification System → BIS

Series V (V = variable) → V

System component → 6
6 = Processor unit

Generation (design/material) → 1
1 = Generation 1, 2011 housing design, metal

Interface → 07
07 = TCP/IP, USB

Software type → 039
039 = Ethernet TCP/IP

Connection system → C005

C005 = *Power supply:* 5-pin flanged male connector with 7/8" external thread
IO-Link Master: Flanged female connector M12 internal thread, 5-pin, A-coded
TCP/IP-Port: Flanged male connector M12 external thread, 5-pin, D-coded
USB-Port: Flanged female connector M12 internal thread, 5-pin, A-coded
4 heads VL/VM and future systems: Flanged female connector M12 internal thread, 5-pin, A-coded

C105 = As for C005, also supports BIS C read/write heads (adapter required)

C006 = *Power supply:* 4-pin flanged male connector with 7/8" external thread
IO-Link-Master: Flanged female connector M12 internal thread, 5-pin, A-coded
TCP/IP-Port: Flanged male connector M12 external thread, 5-pin, D-coded
USB-Port: Flanged female connector M12 internal thread, 5-pin, A-coded
4 heads VL/VM and future systems: Flanged female connector M12 internal thread, 5-pin, A-coded

C106 = As for C006, also supports BIS C read/write heads (adapter required)

C007 = *Power supply:* Flanged male connector with external M12 thread, 5-pin, L-coded
IO-Link-Master: Flanged female connector M12 internal thread, 5-pin, A-coded
TCP/IP-Port: Flanged male connector M12 external thread, 5-pin, D-coded
USB-Port: Flanged female connector M12 internal thread, 5-pin, A-coded
4 heads VL/VM and future systems: Flanged female connector M12 internal thread, 5-pin, A-coded

C107 = As for C007, also supports BIS C read/write heads (adapter required)

C008 = *Power supply:* Flanged male connector with external M12 thread, 4-pin, L-coded
IO-Link-Master: Flanged female connector M12 internal thread, 5-pin, A-coded
TCP/IP-Port: Flanged male connector M12 external thread, 5-pin, D-coded
USB-Port: Flanged female connector M12 internal thread, 5-pin, A-coded
4 heads VL/VM and future systems: Flanged female connector M12 internal thread, 5-pin, A-coded

C108 = As for C008, also supports BIS C read/write heads (adapter required)

Accessories (optional, not included)

Note
Addition accessories for BIS V-6107-_ _ can be found online at www.balluff.com.

Appendix

ASCII table

Decimal	Hex	Control Code	ASCII
0	00	Ctrl @	NUL
1	01	Ctrl A	SOH
2	02	Ctrl B	STX
3	03	Ctrl C	ETX
4	04	Ctrl D	EOT
5	05	Ctrl E	ENQ
6	06	Ctrl F	ACK
7	07	Ctrl G	BEL
8	08	Ctrl H	BS
9	09	Ctrl I	HT
10	0A	Ctrl J	LF
11	0B	Ctrl K	VT
12	0C	Ctrl L	FF
13	0D	Ctrl M	CR
14	0E	Ctrl N	SO
15	0F	Ctrl O	SI
16	10	Ctrl P	DLE
17	11	Ctrl Q	DC1
18	12	Ctrl R	DC2
19	13	Ctrl S	DC3
20	14	Ctrl T	DC4
21	15	Ctrl U	NAK
22	16	Ctrl V	SYN
23	17	Ctrl W	ETB
24	18	Ctrl X	CAN
25	19	Ctrl Y	EM
26	1A	Ctrl Z	SUB
27	1B	Ctrl [	ESC
28	1C	Ctrl \	FS
29	1D	Ctrl]	GS
30	1E	Ctrl ^	RS
31	1F	Ctrl _	US
32	20		SP
33	21		!
34	22		„
35	23		#
36	24		$
37	25		%
38	26		&
39	27		‘
40	28		(
41	29		)
42	2A		*

Decimal	Hex	ASCII
43	2B	+
44	2C	,
45	2D	-
46	2E	.
47	2F	/
48	30	0
49	31	1
50	32	2
51	33	3
52	34	4
53	35	5
54	36	6
55	37	7
56	38	8
57	39	9
58	3A	:
59	3B	;
60	3C	<
61	3D	=
62	3E	>
63	3F	?
64	40	@
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
70	46	F
71	47	G
72	48	H
73	49	I
74	4A	J
75	4B	K
76	4C	L
77	4D	M
78	4E	N
79	4F	O
80	50	P
81	51	Q
82	52	R
83	53	S
84	54	T
85	55	U

Decimal	Hex	ASCII
86	56	V
87	57	W
88	58	X
89	59	Y
90	5A	Z
91	5B	[
92	5C	\
93	5D	[
94	5E	^
95	5F	_
96	60	`
97	61	a
98	62	b
99	63	c
100	64	d
101	65	e
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	o
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	77	w
120	78	x
121	79	y
122	7A	z
123	7B	{
124	7C	|
125	7D	}
126	7E	~
127	7F	DEL

Index

Index

www.balluff.com

Headquarters

Germany
Balluff GmbH
Schurwaldstrasse 9
73765 Neuhausen a.d.F.
Phone +49 7158 173-0
Fax +49 7158 5010
balluff@balluff.de

DACH Service Center

Germany
Balluff GmbH
Schurwaldstrasse 9
73765 Neuhausen a.d.F.
Phone +49 7158 173-370
service.de@balluff.de

Southern Europe Service Center

Italy
Balluff Automation S.R.L.
Corso Cuneo 15
10078 Venaria Reale (Torino)
Phone +39 0113150711
service.it@balluff.it

Eastern Europe Service Center

Poland
Balluff Sp. z o.o.
Ul. Graniczna 21A
54-516 Wrocław
Phone +48 71 382 09 02
service.pl@balluff.pl

Americas Service Center

USA
Balluff Inc.
8125 Holton Drive
Florence, KY 41042
Toll-free +1 800 543 8390
Fax +1 859 727 4823
service.us@balluff.com

Asia Pacific Service Center

Greater China
Balluff Automation (Shanghai) Co., Ltd.
No. 800 Chengshan Rd, 8F, Building A,
Yunding International Commercial Plaza
200125, Pudong, Shanghai
Phone +86 400 820 0016
Fax +86 400 920 2622
service.cn@balluff.com.cn

No. 933434-726 EN · 05.130298 · I20; Subject to modification. Replaces H20.